THE HEALTH STATUS OF PACIFIC CHILDREN AND YOUNG PEOPLE IN NEW ZEALAND

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"*The patterns and colour symbolise my cultural identity*"
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Executive Summary

Introduction

This report is the first of three reports, in the second series on the health of Pacific children and young people in New Zealand, and fits into the current reporting cycle as follows:

1. Year 1 (2008) Health Outcomes
2. Year 2 (2009) Health Determinants
3. Year 3 (2010) Disability and Chronic Conditions

While the aim of the first reporting cycle was to develop an overall map of the major issues affecting the health of Pacific children and young people in New Zealand, this second series, while building on the framework developed in the first, aims to move beyond the sole provision of descriptive health statistics. In particular, it seeks to assist those working to improve child and youth health nationally, to utilise all of the available evidence when developing programmes and interventions to address child and youth health need. As a consequence, the reports in this second series contain a number of new features not present in the first. These include:

Additional Topics

This year, Stillbirths were selected by the Pacific Child and Youth Health Reference Group for more in-depth review. Thus a chapter on Fetal Deaths has been included which:

1. Describes the distribution of stillbirths amongst Pacific groups in New Zealand
2. Identifies possible explanations for the higher stillbirth rates among Pacific communities.
3. Considers whether there are any population level approaches which might be implemented by the health sector to reduce the excess stillbirth risk experienced by Pacific women and their families.

The review begins by briefly summarising some of the terms used to define stillbirth in the international literature, before reviewing stillbirth rates amongst Pacific babies in New Zealand using data from the National Mortality Collection. The most common causes and risk factors for stillbirths are then reviewed using the New Zealand and international literatures, with a particular emphasis being placed on those risk factors which are more common in Pacific communities. The differences between unexplained and uninvestigated stillbirths and the role post-mortems play in this context are then highlighted, before possible approaches to preventing stillbirths are considered. It is hoped that the information contained in this review will be used by the health sector to develop prevention strategies which ultimately reduce the number of stillbirths experienced by Pacific women in New Zealand.

In addition, two other topics, selected by DHBs for inclusion in their local reports, have been included in this report, due to their relevance to Pacific children. These are:

1. **Initiatives to Increase Breastfeeding**: This topic explores the benefits of breastfeeding, before considering breastfeeding rates in New Zealand and overseas. Barriers to effective breastfeeding are then identified, along with local policy documents and international reviews which consider interventions to improve breastfeeding rates.
2. **Understanding Ambulatory Sensitive Hospitalisations (ASH):** ASH are a group of conditions potentially avoidable through early access to treatment in primary care. In this report, a composite ASH section briefly explores New Zealand's recent approaches to monitoring ASH, ASH rates in Pacific children in New Zealand, and a range of policies and interventions aimed at increasing access to, and the quality of, primary care. In addition, each ASH condition is explored in its own stand alone section, allowing the reader to also consider ASH reduction strategies which address each of its component causes.

Evidence Based Approaches to Intervention

For each of the indicators in this year's report, a brief overview of relevant local policy documents (e.g. MOH Strategies / Toolkits) and international evidence based reviews of population level approaches to prevention / management is presented. **Appendix 2** outlines the methodology used to undertake these reviews, which aim to provide busy Ministry of Health staff with a logical starting point for considering the interventions available to address particular child and youth health needs. In preparing these overviews, the methodology used was not exhaustive, but rather involved searching a restricted number of Evidence Based Medicine (EBM) journals and databases (e.g. the Cochrane Library) for systematic reviews which considered population level approaches particular to child and youth health issues.

In undertaking this task, it quickly became apparent that the quality of evidence varied considerably depending on the issue reviewed. In addition, in some cases the research provided reasonably strong guidance as what did not work, but little advice as to effective approaches. Thus, in many cases, these brief overviews serve to highlight the current paucity of evidence on population level interventions to address child and youth health needs, although the absence of systematic / other reviews, does not rule out the existence of individual studies in particular areas. In addition, while the search strategy utilised did not primarily aim to identify individual studies, or reviews of individual patient therapies, in cases where such studies were identified, and where no other systematic reviews were available, these were included as *Other Relevant Publications*. In such cases however, the reader needs to be aware that these studies were identified in a non-systematic manner and thus their findings should not be given the same weight as systematic reviews (e.g. Cochrane reviews) where all of the available evidence has been evaluated using a rigorous methodology.

New Indicators

A number of new indicators have been developed specifically for this report. These include a number of ASH conditions (e.g. gastro-oesophageal reflux, constipation, dental caries and otitis media), as well as a review of waiting list admissions for two common paediatric procedures: grommets and tonsillectomy.

Ethnicity Classifications and Data Quality Issues

As previously, a number of data quality issues must also be taken into account when interpreting the information in this report. A number of these relate to the ethnicity classifications used and these are briefly summarised in the text box below. A more detailed review of these issues is also contained in the series of Sections / Appendices at the back of this report. The reader is urged to be aware of the contents of these when interpreting any of the data presented in this report.

Interpreting Ethnic Specific Rates and Trends: Data Quality Issues and Limitations

This report brings together routinely collected data on the health of Pacific children and young people in New Zealand. When interpreting this data, a number of limitations need to be taken into consideration:

1. *The Calculation of Ethnic Specific Rates*: The majority of rates calculated in this report have relied on the division of numerators (e.g. hospital admissions, mortality data) by Census or Birth Registration denominators. Calculation of accurate ethic specific rates relies on the assumption that information on ethnicity is collected in a similar manner in both the numerator and denominator and that a single child will be identified similarly in each. In New Zealand this has not always been the case, and even with the improvements in the collection of ethnicity data which have occurred over the past decade, there still remains the possibility the same individual will be identified differently in different data collections.

This is of particular concern in the context of reporting multiple ethnicities and has implications for the interpretation of differences between the Sole and (Any) Pacific groups highlighted in this report (e.g. if parents tend to identify children as having only a single Pacific identity in hospital admission data, but report multiple ethnic affiliations in the Census, this may potentially increase hospital admission rates for Sole Pacific children when compared with (Any) Pacific children). While the extent to which this actually occurs is difficult to quantify, the reader must nevertheless include data quality issues in the list of possible factors contributing to the differences between Sole and (Any) Pacific children and young people highlighted in this report. The Section on **Demography and the Measurement of Ethnicity** at the back of this report provides an overview of how ethnicity information has been collected over time in New Zealand's national data collections, and the various ethnicity classifications used in this report

(Prioritised, Any and Sole Pacific). The reader is urged to review this section before interpreting any of the ethnic specific analyses presented.

2. Changes in Uploading Emergency Department Cases to the Hospital Admission Dataset Over Time: **Appendix 4** outlines a number of issues associated with the Hospital Admission Dataset, and in particular how changes in the way in which emergency department cases have been uploaded to the national minimum dataset can profoundly affect time series data for a number of conditions commonly dealt with in the emergency department setting (e.g. injuries, asthma, gastroenteritis). This problem is of particular importance for paediatric admissions in the Auckland region, and with nearly 2/3 of Pacific children and young people in New Zealand residing in Auckland, also has implications for the interpretation of Pacific child and youth health statistics. A more detailed overview of this issue is provided in **Appendix 4**, and the reader is strongly urged to read this Appendix before attempting to interpret any of the time series information on hospital admissions in this report.

3. The Signalling of Statistical Significance: **Appendix 1** outlines the rationale for the use of statistical significance testing in this report. In brief, all of the data in this report can be considered as belonging to one of two groups: Population Surveys (which use a sample to make inferences about the population as a whole) and Routine Administrative Datasets (which capture information on all events occurring in a particular category e.g. all deaths from a particular cause). The way in which each is handled for the purposes of statistical significance testing differs (as outlined in **Appendix 1**). Where relevant, the significance of any associations has been signalled in the text (with the words *significant* or *not significant* in italics being used to denote the statistical significance of the observed association). Where the words significant or non-significant do not appear in the text, then the associations described do not imply statistical significance or non-significance".

Overview of the Health Status of Pacific Children and Young People in New Zealand

While it is hoped these additional features will serve to enhance the utility of the information presented, the need for a consistent approach to monitoring child and youth health status over time means that the way the epidemiological data is presented in this report is similar to previous years. **Table 1** thus provides a brief overview of each of the indicators contained in this report, including their distribution nationally and across different Pacific ethnic groups.

Conclusions

In addition to providing an overview of the health status of Pacific children and young people in New Zealand, this report also aims to provide an entry point into the policy / evidence based review literature, so that child and youth health needs can be addressed in a systematic and evidence based manner. In undertaking this task, it is suggested that the epidemiological data in this report is combined with knowledge of existing services and stakeholders' views. In addition, any approaches developed need also to be congruent with current Ministry of Health Policy, and the evidence contained in the current literature. Finally, for those developing new approaches in areas where there is currently no sound evidence base, the plea is that they build into their programmes an evaluation arm, so that any learning gained can be used by others to enhance the wellbeing of Pacific children and young people and to ensure the best use of available resources.

Table 1. Overview of the Health Status of Pacific Children and Young People in New Zealand

Stream	Indicators	New Zealand and Pacific Distribution and Trends
Issues More Common in Infancy		
Perinatal and Infancy	Fetal Deaths	During 2001-2005, congenital anomalies were the leading cause of intermediate fetal death for Any Pacific babies, followed by those for whom the cause was unspecified. For late fetal deaths, the leading cause was unspecified, followed by those dying from asphyxia, anoxia or trauma. For Sole Pacific babies however, unspecified causes were the leading cause of both intermediate and late fetal death. When broken down by gestational age, fetal deaths exhibited a U-shaped distribution, with rates being high <25 weeks, lower in mid-gestation and then rising again as term approached. While intermediate fetal deaths were similar for European, Māori and Pacific babies, rates were *significantly higher* for Asian babies. In contrast, late fetal deaths were *significantly higher* for Pacific babies and those in the most deprived areas, while unspecified fetal deaths were *significantly higher* for Pacific and Māori babies and those in more deprived areas. During 2001-2005, intermediate fetal deaths for babies each of the Sole and Any Pacific groups were *not significantly different* from non-Māori non-Pacific babies (with the exception of Tokelauan and Other Pacific babies and Sole Fijian and Niuean babies, where small numbers precluded a valid analysis). In contrast, late fetal death rates for Sole and Any Pacific babies as a whole were *significantly higher* than for non-Māori non-Pacific babies, although within the individual Pacific groups, rates were only *significantly higher* for Sole Samoan and Niuean babies and Any Fijian babies.
	Preterm Birth	In New Zealand during 1980-2007, preterm birth rates increased, with the most rapid increases occurring during the late 1990s. Rates peaked in 1998-1999 and since then have declined slightly. During 2003-2007, preterm birth rates for Pacific babies were similar to those for European and Asian babies, but *significantly lower* than for Māori babies. Preterm birth rates were also *significantly higher* for males and those in more deprived or urban areas. During the same period (using the Sole / Any classification), preterm birth rates were *significantly higher* for Sole and Any Cook Island Māori and Other Pacific babies than for non-Māori non-Pacific babies. In contrast, preterm birth rates for Sole Samoan and Any Tongan babies were *significantly lower* than for non-Māori non-Pacific babies.
	Breastfeeding	In New Zealand during 2004-2008, breastfeeding rates for Pacific women were consistently lower than for European women at <6 weeks, 3 months and 6 months, although differences between Pacific women and Māori and Asian women were less consistent. During 2008, Pacific women's breastfeeding rates of 53.3% at <6 weeks, 42.6% at 3 months and 17.9% at 6 months were lower than the Ministry of Health's targets of 74% at 6 weeks, 57% at three months and 27% at six months.
	Gastro-Oesophageal Reflux	In New Zealand during 1996-2007, gastro-oesophageal reflux admissions in infants initially increased, reached a peak in 2000-01 and thereafter declined. During 2003-2007, admissions peaked at 4-7 weeks of age, with numbers then tapering off progressively until 28-31 weeks, after which they became relatively static. While admissions were *significantly lower* for Pacific infants than for European infants, rates were *significantly higher* for males and those in urban or very affluent (NZDep Decile 1) areas (compared to those in very deprived (NZDep Decile 10) areas). During the same period, admissions for Any and Sole Samoan, Tongan and Cook Island Māori infants were *significantly lower* than for non-Māori non-Pacific infants. Small numbers however precluded valid comparisons for other Pacific groups, with the exception of Any Fijian infants, where rates were similar to those of non-Māori non-Pacific infants.

Stream	Indicators	New Zealand and Pacific Distribution and Trends
Perinatal and Infancy	Infant Mortality and SUDI	**Total Infant Mortality:** In New Zealand during 1988-2005, total, neonatal and post-neonatal mortality all declined, with the most rapid declines occurring during the early-mid 1990s. Since 1998-99, total and neonatal mortality have become more static. During 1996-2005, total infant mortality was higher for Māori and Pacific > European > Asian infants. While post-neonatal mortality was higher for Māori > Pacific > European and Asian infants, neonatal mortality for Māori and Pacific infants was more similar (although rates for both groups were higher than for European and Asian infants). **Neonatal Mortality:** During 2001-2005, the most frequent causes of neonatal mortality for both Sole and Any Pacific infants were extreme prematurity and congenital anomalies, although intrauterine / birth asphyxia also made a small contribution. **Post Neonatal Mortality:** During 2001-2005, the most frequent cause of post-neonatal mortality for both Any and Sole Pacific infants was SIDS, although a number of deaths were also attributed to suffocation / strangulation in bed and unspecified causes. Congenital anomalies also made a significant contribution. **Sudden Unexpected Death in Infancy (SUDI):** In New Zealand during 1988-2005 SIDS rates declined, although increases in the number of babies dying from suffocation / strangulation in bed or due to unspecified causes meant that declines in overall SUDI rates were not as marked as those for SIDS during this period. During 2001-2005, SUDI was *significantly higher* for Māori > Pacific > European and Asian infants and those in the more deprived areas. During 1996-2005, SUDI rates were similar for Sole and Any Pacific infants.
Issues More Common in Children		
Total and Avoidable Morbidity and Mortality	Most Frequent Causes of Hospital Admission and Mortality	**Mortality:** During 2001-2005, SUDI was the leading cause of post-neonatal mortality for Any Pacific infants, while congenital anomalies were the leading cause for Sole Pacific infants. In contrast, injury / poisoning was the leading cause of mortality for both Any and Sole Pacific children aged 1-14 years, followed by congenital anomalies and neoplasms. **Hospital Admissions:** During 2003-2007, bronchiolitis and injury / poisoning were the leading reasons for acute admissions in Any and Sole Pacific children. Neoplasms / chemotherapy / radiotherapy and injury / poisoning were the leading reasons for arranged admissions while dental procedures and grommets were the leading reasons for waiting list admissions.
	Ambulatory Sensitive Hospital Admissions	During 2003-2007, bacterial / non-viral pneumonia, asthma and gastroenteritis made the greatest contribution to ASH rates for both Any and Sole Pacific children if ED cases were included, while bacterial / non viral pneumonia, asthma and dental conditions made the greatest contribution if ED cases were excluded. During the same period, ASH rates were *significantly higher* for Pacific and Māori children, males and those living in urban or more deprived areas irrespective of whether ED cases were included or excluded. Rates for Asian children however, were *significantly higher* than for European children if ED cases were included, but *significantly lower* than for European children if ED cases were excluded. Admissions were also higher during late winter and early spring. During 2003-2007 (using the Sole / Any classification), ASH admissions for Pacific children were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Groups, irrespective of whether ED cases were included or excluded. Within the Any categories, ASH admissions for Cook Island Māori, Niuean and Tokelauan children were *significantly lower* than for Samoan and Tongan children, irrespective of whether ED cases were included or excluded. Within the Sole Categories, ASH admissions for Cook Island Māori children were *significantly lower* than for Samoan and Tongan children if ED cases were included, and significantly lower than for Samoan children if ED cases were excluded.

Stream	Indicators	New Zealand and Pacific Distribution and Trends
Upper Respiratory Tract Infections	Acute Upper Respiratory Infections and Tonsillectomy	**Acute Upper Respiratory Infections:** During 2003-2007, acute unspecified upper respiratory infections were the most frequent cause of acute upper respiratory tract infection (URTI) admissions for Any and Sole Pacific children, followed by croup / laryngitis / tracheitis. During this period, croup / laryngitis / tracheitis admissions were *significantly higher* for Pacific children (than for European or Asian children), males and those in deprived or urban areas, while acute URTI admissions were *significantly higher* for Pacific > Māori > European > Asian children, males and those in deprived or urban areas. During 2003-2007 croup / laryngitis / tracheitis admissions for Any Samoan, Tongan, Cook Island Māori and Other Pacific children were similar to those for non-Māori non-Pacific children, although rates for children belonging Solely to these four ethnic groups were *significantly higher*. For acute URTI admissions, rates for Any and Sole Samoan, Tongan, Fijian and Other Pacific children, as well as for Sole Cook Island Māori and Niuean children were *significantly higher* than for non-Māori non-Pacific children. In contrast, admissions for Any Cook Island Māori and Niuean children were *significantly lower* than for non-Māori non-Pacific children **Waiting List Admissions for (Adeno)Tonsillectomy**: During 2003-2007, chronic tonsillitis was the most common reason why Any and Sole Pacific children were admitted from the waiting list for (adeno)tonsillectomy, followed by hypertrophy of the tonsils and adenoids. During this period, admissions for (adeno)tonsillectomy were *significantly lower* for Pacific children than for Māori or European children. Admissions were *significantly higher* for those in urban or more deprived areas. During 1996-2007, (using the Sole / Any Classification), waiting list admissions for (adeno)tonsillectomy were generally lower for Sole and Any Tongan and Any Cook Island Māori children than for Sole or Any Samoan children. During 2003-2007, admissions for each of the Any Pacific groups (with the exception of Any Fijian children) were *significantly lower* than for non-Māori non-Pacific children. Admissions for Sole Samoan, Tongan and Cook Island Māori children were also *significantly lower* than for non-Māori non-Pacific children.
	Middle Ear Problems: Hearing Screening, Otitis Media and Grommets	**Hearing Screening:** In New Zealand during 1993-2006 there was a gradual decline in audiometry failure rates at school entry, with rates falling from 9.7% in 1993, to 6.6% in 2006. While rates for Pacific children also declined (from 14.0% in 1992 to 11.2% in 2006), rates remained higher than for European / Other (1993-2001) and European and Asian (2002-2006) children. Audiometry failure rates for Pacific children were also higher than for Māori children for the majority of this period. **Otitis Media and Grommets:** In New Zealand during 2003-2007, otitis media was the most frequent cause of acute / arranged hospital admissions for middle ear and mastoid conditions amongst Any and Sole Pacific children, as well as the most frequent indication for waiting list admissions for the insertion of grommets. During this period, acute / arranged admissions for otitis media reached a peak between 1-2 years of age and thereafter declined, with the age profile being similar for all ethnic groups. In contrast, waiting list admissions for grommets were highest for European > Māori > Pacific > Asian children during their pre-school years, but became higher for Pacific and Māori children than for European children during the primary school years. During 2003-2007 (using the Sole / Any classification), acute / arranged admissions for otitis media were *significantly higher* for Sole and Any Samoan, Tongan and Other Pacific children and for Sole Cook Island Māori, Niuean and Tokelauan children than for non-Māori non-Pacific children. Similarly, waiting list admissions for the insertion of grommets were *significantly higher* for each of the Sole and Any Pacific groups (with the exception of Sole and Any Fijian and Sole Tokelauan children) than for non-Māori non-Pacific children. In addition, admissions were *significantly higher* for Sole Cook Island Māori and Niuean children than for Sole Samoan and Tongan children.

Stream	Indicators	New Zealand and Pacific Distribution and Trends
Lower Respiratory Tract Conditions	Bronchiolitis	In New Zealand during 1990-2007, bronchiolitis admissions in infants <1 year increased, reached a peak in 2002-03 and thereafter declined. Despite this, mortality during 1990-2005 remained relatively static. When broken down by age, the majority of bronchiolitis admissions and deaths occurred during the first year of life, although a small number also occurred between 1-2 years of age. During 2003-2007, bronchiolitis admissions were *significantly higher* for Pacific > Māori > European > Asian infants, males and those in urban or deprived areas. During 2003-2007 (using the Sole / Any classification), bronchiolitis admissions for Pacific infants were *significantly higher* than for non-Māori non-Pacific infants in each of the Sole and Any Pacific Groups. Within the Any Category, admissions were *significantly higher* for Tongan and Samoan infants than for Cook Island Māori, Niue, Fijian and 'Other' Pacific infants. Within the Sole Category, admissions were *significantly higher* for Niue, Samoan and Tongan infants than for Cook Island Māori, Fijian and Other Pacific infants.
	Asthma	In New Zealand during 1990-2007, asthma admissions in young people declined. While admissions for children also declined during 1990-2003, an upswing in rates was evident during 2004-2007. Despite this, mortality during 1994-2005 remained relatively static. During 2003-2007, asthma admissions were highest for children <5 years, while mortality during 2001-2005 was highest for those in their late teens and early twenties. Asthma admissions were also *significantly higher* for Pacific > Māori > Asian > European children, males and those in urban or deprived areas. During 2003-2007 (using the Sole / Any classification), asthma admissions for Pacific children were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Groups. Within the Any and Sole categories, asthma admissions for Cook Island Māori children were *significantly lower* than for Samoan, Tongan, Niue and Fijian children. Rates for Sole Cook Island Māori children were also *significantly lower* than for Sole Tokelauan and Other Pacific children.
	Bacterial/Viral Pneumonia	In New Zealand during 1992-2007, hospital admissions for bacterial / viral pneumonia remained relatively static in both children and young people. Similarly mortality changed little during 1990-2005. During 2003-2007, pneumonia admissions were highest for children <3 years and tapered off rapidly thereafter. A similar pattern was seen for mortality during 2001-2005, with the highest rates being in infants <1 year. Pneumonia admissions were also *significantly higher* for Pacific > Māori > Asian > European children, males and those in urban or deprived areas. During 2003-2007 (using the Sole / Any classification), pneumonia admissions for Pacific children were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Groups. Within the Any Category, pneumonia admissions for Tongan and Samoan children were *significantly higher* than for Cook Island Māori, Niue, Fijian and Tokelauan children. Within the Sole Category, pneumonia admissions for Cook Island Māori children were *significantly lower* than for Tongan, Samoan or Niue children.

Stream	Indicators	New Zealand and Pacific Distribution and Trends
Lower Respiratory Tract Conditions	Bronchiectasis	In New Zealand during 1990-2007, bronchiectasis admissions in children and young people increased rapidly, reached a peak in 2004-2005 and thereafter declined. Care must be taken when interpreting these trends however, as it remains unclear whether they represent an increase in the underlying burden of disease, an increase in access to hospitalisation, or an increase in the use of High Resolution CT to diagnose bronchiectasis in this population. Mortality trends during 1990-2005 were more inconsistent. During 2003-2007, bronchiectasis admissions were highest for those <17 years of age. Admissions were also *significantly higher* for Pacific > Māori > European and Asian children and young people, and those living in urban or deprived areas. During 2003-2007 (using the Sole / Any classification), bronchiectasis admissions for Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of Fijian children and young people). Within the Any Category, bronchiectasis admissions for Niue, Tongan and Samoan children and young people were *significantly higher* than for Cook Island Māori and Fijian children and young people. Within the Sole Category, bronchiectasis admissions for Niue children and young people were *significantly higher* than for the other Pacific groups.
Infectious Diseases	Immunisation Coverage	In New Zealand in the 12 months ending 30th June 2008, 57.8% of Pacific children were fully immunised at 6 months, 84.5% at 12 months, 65.6% at 18 months and 74.7% at 24 months of age. Higher coverage rates at 12 months reflect that there are no additional immunisations scheduled between the 5 month vaccination and 12 months, thus allowing children time to "catch up" late vaccinations. A similar phenomenon occurs between 15 and at 24 months, potentially suggesting that a significant number of children are not receiving their vaccinations in a timely manner.
	Hospital Admissions for Pertussis and Other VPDs	**Pertussis Admissions:** In New Zealand during 1990-2007, pertussis epidemics occurred at regular 3-4 year intervals, with the last epidemic occurring in 2004. During 2003-2007, pertussis admissions were significantly higher for Pacific and Māori > European > Asian infants, and those living in urban or deprived areas. When broken down by age, the majority of pertussis admissions and all recent deaths were in infants <1 year. During 2002-2006 (using the Sole / Any classification), pertussis admissions for Pacific infants were significantly higher than for non-Māori non-Pacific infants in each of the Sole and Any Groups (with the exception of Fijian, Tokelauan and Other Pacific infants, where small numbers prevented a valid comparison). Within the Any and Sole categories however, the majority of differences between individual Pacific groups did not reach statistical significance.

Stream	Indicators	New Zealand and Pacific Distribution and Trends
Infectious Diseases	Meningococcal Disease	During the 1990s New Zealand experienced large increases in admissions and mortality from meningococcal disease, with rates peaking during the late 1990s-early 2000s. Since 2002-2003 however, both admissions and mortality have declined. During 2003-2007, admissions were *significantly higher* for Pacific > Māori > European > Asian children and young people, males and those living in urban or deprived areas. While admissions declined for all ethnic groups during 1996-2007, declines were greater for Pacific and Māori children and young people. During the mid-late 1990s (using the Sole / Any classification), meningococcal disease admissions were higher for Tongan than for Samoan or Cook Island Māori children and young people. These differences decreased during the late-1990s and early 2000s, so that by 2006-07 rates were similar for all three Pacific groups. During 2003-2007, meningococcal disease admissions for Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of Tokelauan and Sole Fijian children and young people, where small numbers precluded a valid comparison). Within the Any Category, admissions were *significantly higher* for Tongan than for Cook Island Māori and Niue children and young people, although differences between groups in the Sole Category were less marked.
	Tuberculosis	In New Zealand during the late 1990s-early 2000s, hospital admissions for TB gradually increased. Rates reached a peak in 2002-2003, and since then have declined. During 1990-2005, three New Zealand children / young people died as a result of TB. During 2003-2007, while there was a small peak in children <3 years, TB admissions were highest for young people in their late teens and early twenties. TB admissions were also *significantly higher* for Asian and Pacific > Māori > European children and young people and those in urban or deprived areas. During 2003-2007 (using the Sole / Any classification), TB admissions for Sole and Any Samoan, Tongan, Cook Island Māori and Other Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people (small numbers prevented valid comparisons for Niuean, Fijian and Tokelauan groups). Within both the Any and Sole Categories, admissions for "Other" Pacific children and young people were *significantly higher* than for Samoan, Cook Island Māori and Tongan children and young people.
	Rheumatic Fever	During 1996-2007, New Zealand's hospital admissions rates for acute rheumatic fever (ARF) and rheumatic heart disease (RHD) remained relatively static, while deaths averaged 1-2 cases per year during 1998-2005. During 2003-2007, ARF admissions were highest for those aged 7-15 years, while RHD admissions were relatively constant (albeit at a much lower rate) after 6 years of age. ARF admissions were also *significantly higher* for Pacific > Māori > European and Asian children and young people, males and those in urban or deprived areas. During 2003-2007 (using the Sole / Any classification), ARF admissions for Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of Fijian groups where small numbers prevented a valid analysis). While admissions were highest for Tokelauan children and young people, the majority of differences between Pacific groups did not reach statistical significance. Similarly during 2003-2007, RHD admissions for Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of the Tokelauan groups where small numbers prevented a valid comparison). While admissions were *significantly higher* for "Other" Pacific children and young people than for most other Pacific groups, small numbers meant that many other differences between Pacific groups did not reach statistical significance.

Stream	Indicators	New Zealand and Pacific Distribution and Trends
Infectious Diseases	Serious Skin Infections	In New Zealand during 1990-2007, hospital admissions for serious skin infections rose progressively, with the most rapid rises occurring during the mid-late 1990s. During 2003-2007, admissions had a bi-modal distribution, with the highest rates occurring in children <5 years of age, followed by young people in their late teens and early 20s. Admissions were also *significantly higher* for Pacific > Māori > European and Asian children, Pacific and Māori > European > Asian young people, males and those in urban or deprived areas. Amongst children during 2003-2007 (using the Sole / Any classification), serious skin infection admissions were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Pacific groups. Within the Any Category, admissions were *significantly higher* for Samoan, Tongan and "Other" Pacific children than for Cook Island Māori, Niue, Tokelauan and Fijian children. Within the Sole Category, differences between individual Pacific groups were much less marked. Amongst young people, admissions for Any and Sole Samoan, Tongan and 'Other" Pacific young people, Any Fijian and Sole Cook Island Māori and Niue young people were *significantly higher* than for non-Māori non-Pacific young people.
	Infectious Gastroenteritis	In New Zealand during 1990-2007, gastroenteritis admissions increased in both children and young people. Despite this, deaths remained static at around 1-2 cases per year during 1990-2005. During 2003-2007, gastroenteritis admissions were highest for children <3 years of age, but tapered off rapidly thereafter. Mortality during 2001-2005 followed a similar pattern. During 2003-2007, gastroenteritis admissions were *significantly higher* for Pacific > Asian > European > Māori children, males and those living in urban or deprived areas. Admissions were also higher during spring. During 2003-2007 (using the Sole / Any Classification), gastroenteritis admissions for all of the Pacific groups within the Sole Category were *significantly higher* than for non-Māori non-Pacific children. Within the Any Category, admissions were *significantly higher* for Samoan, Tongan, Fijian and Other Pacific children than for non-Māori non-Pacific children. In contrast, admissions for Any Cook Island Māori and Niuean children were *significantly lower*.
Other Issues	Oral Health	**School Dental Service Data:** During 1990-2006, a higher % of children were caries free at 5 years in fluoridated areas than in non-fluoridated areas, while mean DMFT scores at 12 years in fluoridated areas were lower. During 2004-2006, a lower % of Pacific and Māori children were caries free at 5 years, while Māori and Pacific children also had higher mean DMFT scores at 12 years, in both fluoridated and non-fluoridated areas. However, only children who have been assessed, completed treatment, and who are still 5 yrs or 12 years at the end of their treatment contribute data to this analysis. During this period, dental data coverage was higher for European > Māori > Pacific children. Thus trends and differences in oral health status for Pacific children must be interpreted with this in mind. **Dental Admissions:** During 1990-2007, dental caries admissions increased markedly for preschool (0-4 years) and school age (5-12 years) children. While admissions for young people (13-18 years) more than trebled, increases were less marked than for younger age groups. During 1996-2007, dental caries admissions were higher for Pacific > Māori > Asian > European preschool age children, for Pacific and Māori > Asian and European primary school age children, and for European > Māori, Pacific and Asian young people. Admissions in all three age groups were higher for Sole than for Any Pacific children and young people. Amongst pre-school age children during 2003-2007 (using the Sole/ Any classification), dental caries admissions for Pacific children were significantly higher than for non-Māori non-Pacific children in each of the Sole and Any groups. While the pattern was similar for primary school age children in the Sole Pacific groups, within the Any groups, admissions were only significantly higher for Samoan, Tongan, Cook Island Māori, Fijian and Tokelauan children.

Stream	Indicators	New Zealand and Pacific Distribution and Trends
Other Issues	Unintentional Injuries	**All Injuries:** During 2003-2007, falls followed by inanimate mechanical forces were the leading causes of injury admissions for Any and Sole Pacific children, while the order was reversed for young people. In contrast, during 2001-2005 accidental threats to breathing were the leading cause of injury related mortality for Any Pacific children, although the majority of deaths occurred in infants <1 year, raising the possibility of diagnostic transfer from SUDI. Pedestrian injuries were the leading cause of injury mortality for Sole Pacific children, followed by accidental threats to breathing. Intentional self harm, followed by vehicle occupant injuries were the leading causes of injury mortality for both Any and Sole Pacific young people. **Unintentional Non-Transport Injuries:** During 1990-2005, unintentional non-transport injury deaths in children and young people gradually declined, although an upswing in rates was evident for young people during 2002-2005. During 2003-2007, unintentional non-transport injury admissions were *significantly higher* for Pacific > Māori > European > Asian children and young people, males and those in more deprived or urban areas. During the same period (using the Sole / Any classification), admissions for children and young people in each of New Zealand's Sole Pacific groups were *significantly higher* than for non-Māori non-Pacific children and young people. While admissions for Any Samoan, Tongan and Other Pacific children and young people and Any Cook Island Māori and Fijian young people were also *significantly higher* than for non-Māori non-Pacific children, admissions for Any Cook Island Māori and Niue children were *significantly lower*. **Land Transport Injuries:** During 1990-2005, land transport mortality declined in both children and young people, although there was a small upswing in rates for young people during 2004-2005. During 2003-2007, land transport injury admissions were *significantly higher* for Māori > European > Pacific > Asian children and young people, males and those in more deprived or rural areas. During the same period (using the Sole / Any classification), admissions for Any Samoan, Tongan, Cook Island Māori and Niue children were *significantly lower* than for non-Māori non-Pacific children. In contrast, admissions for children in each of the Sole Pacific groups were similar to those of non-Māori non-Pacific children, with the exception of Fijian children, where rates were *significantly higher* (small numbers prevented valid comparisons for Tokelauan children). During the same period, admissions for young people in each of the Any Pacific groups (with the exception of Tokelauan and Other Pacific young people) were *significantly lower* than for non-Māori non-Pacific young people. Admissions were also *significantly lower* for Sole Samoan, Tongan and Cook Island Māori young people.
	Constipation	In New Zealand, hospital admissions for constipation in children increased during the 1990s, reached a plateau in 2000-2005 and thereafter began to decline. During 2003-2007, admissions nationally were highest amongst children <4 years, with admissions declining progressively after 10 years of age. Admissions were also *significantly higher* for European > Māori > Pacific and Asian children and those in more deprived or urban areas. During 1996-2007, there were no consistent differences in constipation admissions between Samoan, Tongan and Cook Island Māori children, although rates for Sole Tongan children were generally lower than for Sole Samoan children. During 2003-2007 (using the Sole/ Any classification), constipation admissions for Sole and Any Samoan, Tongan and Cook Island Māori children were *significantly lower* than for non-Māori non-pacific children, as were admissions for Any Niuean children.

Issues More Common in Young People		
Total and Avoidable Morbidity and Mortality	Most Frequent Causes of Hospital Admission and Mortality	**Mortality:** During 2001-2005, injury / poisoning was the most frequent cause of mortality for both Sole and Any Pacific young people, followed by intentional self harm. Neoplasms however also made a significant contribution. **Admissions:** During 2003-2007, pregnancy and childbirth were the leading causes of hospital admission for both Any and Sole Pacific young people. In terms of other admissions, injury / poisoning and serious skin infections were the leading causes of acute admissions, injury / poisoning and neoplasms / chemotherapy / radiotherapy were the leading reasons for arranged admissions, and removal of internal fixation devices and procedures on the skin and subcutaneous tissue were the leading causes of waiting list admissions for both Any and Sole Pacific young people.
Sexual and Reproductive Health	Teenage Births	While New Zealand's teenage birth rates remained relatively static during 1983-2007, teenage pregnancy rates increased, as the result of an increase in the number of teenagers seeking an abortion. By 2003, for every woman giving birth in her teenage years, there was one corresponding termination of pregnancy. During 2003-2007, teenage birth rates were *significantly higher* for Māori > Pacific > European > Asian women and those in urban or deprived areas. Higher teenage birth rates for Māori and Pacific women resulted from a shift to the left in the maternal age distribution (i.e. towards birth at a younger age), as well as the higher overall fertility (at all ages) for Māori and Pacific women. During 2003-2007 (using the Sole / Any Classification), teenage birth rates for all of New Zealand's largest Pacific groups (with the exception of Sole Fijian women) were *significantly higher* than for non-Māori non-Pacific women. Within the Any category, teenage birth rates for Cook Island Māori and Niue women were *significantly higher* than for the other Pacific groups studied. Within the Sole category, rates for Cook Island Māori and Niue women were *significantly higher* than for Samoan, Tongan and Fijian women.
	Terminations of Pregnancy	In New Zealand during 1980-2007, terminations of pregnancy increased for all age groups (with the exception of those 11-14 and 45+ yrs). During 2007, terminations were highest for women 20-24 years, followed by those 15-19 and 25-29 years. During 2002-2007, terminations were higher for Pacific, Asian and Māori women than for European women. Ethnic differences, however, need to be viewed in the context of overall fertility rates, as while Pacific and Māori women had higher termination rates, they also had higher overall fertility. Once this was taken into account, the proportion of terminations to births was highest for Asian women and European women in their teenage years.
	Sexually Transmitted Infections	National laboratory based surveillance during 2001-2007 suggested that chlamydia and gonorrhoea were both relatively common infections amongst those aged <25 years and that rates for both conditions were exhibiting a general upward trend. This is of concern, as STIs can lead to the development of serious sequelae such as pelvic inflammatory disease, ectopic pregnancy and infertility, as well as facilitating the transmission of HIV. While data limitations meant that reliable ethnic specific rates could not be calculated, the available evidence would suggest that STIs are as much of an issue for Pacific young people in New Zealand as they are for other ethnic groups.

INTRODUCTION

Introduction

This report is the first of three reports, in the second series on the health of Pacific children and young people in New Zealand, and fits into the current reporting cycle as follows:

1. Year 1 (2008) Health Outcomes
2. Year 2 (2009) Health Determinants
3. Year 3 (2010) Disability and Chronic Conditions

While the aim of the first reporting cycle was to develop an overall map of the major issues affecting the health of Pacific children and young people in New Zealand, this second series, while building on the framework developed in the first, aims to move beyond the sole provision of descriptive health statistics. In particular, it seeks to assist those working to improve child and youth health nationally, to utilise all of the available evidence when developing programmes and interventions to address child and youth health need. As a consequence, the reports in this second series contain a number of new features not present in the first. These include:

Additional Topics
This year, Stillbirths were selected by the Pacific Child and Youth Health Reference Group for more in-depth review. Thus a chapter on Fetal Deaths has been included which:

1. Describes the distribution of stillbirths amongst Pacific groups in New Zealand
2. Identifies possible explanations for the higher stillbirth rates among Pacific communities.
3. Considers whether there are any population level approaches which might be implemented by the health sector to reduce the excess stillbirth risk experienced by Pacific women and their families.

The review begins by briefly summarising some of the terms used to define stillbirth in the international literature, before reviewing stillbirth rates amongst Pacific babies in New Zealand using data from the National Mortality Collection. The most common causes and risk factors for stillbirths are then reviewed using the New Zealand and international literatures, with a particular emphasis being placed on those risk factors which are more common in Pacific communities. The differences between unexplained and uninvestigated stillbirths and the role post-mortems play in this context are then highlighted, before possible approaches to preventing stillbirths are considered. It is hoped that the information contained in this review will be used by the health sector to develop prevention strategies which ultimately reduce the number of stillbirths experienced by Pacific women in New Zealand.

In addition, two other topics reviews, selected by DHBs for inclusion in their local reports, have also been included in this report, due to their relevance to Pacific children. These are:

1. **Initiatives to Increase Breastfeeding**: This topic explores the benefits of breastfeeding, before considering breastfeeding rates in New Zealand and overseas. Barriers to effective breastfeeding are then identified, along with local policy documents and international reviews which consider interventions to improve breastfeeding rates.
2. **Understanding Ambulatory Sensitive Hospitalisations (ASH):** ASH are a group of conditions potentially avoidable through early access to treatment in primary care. In this report, a composite ASH section briefly explores New Zealand's recent approaches to monitoring ASH, ASH rates in Pacific children in New Zealand, and a range of policies and interventions aimed at increasing access to, and the quality of, primary care. In addition, each ASH condition is explored in its own stand alone section, allowing the reader to also consider ASH reduction strategies which address each of its component causes.

Evidence Based Approaches to Intervention

Each of the sections in this year's report concludes with a brief overview of New Zealand's policy documents (e.g. MOH Strategies / Toolkits) relevant to the area, as well as (international) reviews which consider the effectiveness of population level approaches to prevention / management. **Appendix 2** provides an overview of the methodology used to undertake these reviews. Briefly, as health research has expanded exponentially in recent years, the evidence based medicine (EBM) movement has emerged as a means of providing busy clinicians with overviews of the latest evidence in particular areas. Such overviews rely on reviewers collating all of the available evidence (e.g. published and unpublished trials and observational studies), evaluating this in a rigorous manner, and then publishing the resulting synthesis in a format which allows clinicians to quickly evaluate the effectiveness of the intervention(s) reviewed. While the evidence base for population level interventions is much less developed than for individual patient therapies (as such interventions often have longer follow up times, more diffuse outcomes, and less readily identifiable "control" groups), there is nevertheless a reasonable body of evidence emerging as to the effectiveness of population level interventions in particular areas.

Thus, these brief overviews aim to provide busy Ministry of Health staff with a logical starting point for considering the types of intervention available to address particular child and youth health issues. In preparing these overviews however, the methodology used was not exhaustive, but rather involved searching a restricted number of EBM journals and databases (e.g. the Cochrane Library) for systematic reviews of population level interventions in child and youth health. When undertaking this task, it quickly became apparent that the quality of evidence varied considerably depending on the issue reviewed (e.g. while a considerable literature exists as to the most effective ways to improve immunisation coverage, there is a paucity of evidence based solutions for the prevention of gastro-oesophageal reflux or constipation). In addition, in many cases the research provided reasonably strong guidance as what did not work (e.g. current evidence suggests additional social support is ineffective in preventing preterm birth in high-risk women), but little advice as to effective interventions.

Thus in many cases, these brief overviews served to highlight the current paucity of evidence on population level interventions to address child and youth health need (although the absence of systematic / other reviews, does not rule out the existence of individual studies in particular areas). In this context, while the search strategy utilised did not primarily aim to identify individual studies, or reviews of individual patient therapies, in cases where such studies were identified, and where no other systematic reviews were available, they were included under the heading of *Other Relevant Publications*. In such cases however, the reader needs to be reminded that these studies were identified in a non-systematic manner and that their findings should thus not be given the same weight as systematic reviews (e.g. Cochrane reviews) where all the available evidence has been evaluated using a rigorous methodology.

New Indicators

A number of new indicators have been developed specifically for this report. These include a number of ASH conditions: gastro-oesophageal reflux, constipation, dental caries, otitis media and upper respiratory tract infections. In addition, waiting list admissions for two common paediatric procedures: grommets and tonsillectomy have been reviewed, with a view to contrasting their distribution (by age, ethnicity, NZDep, gender, rural / urban) with those of children being admitted acutely for related diagnoses (e.g. acute upper respiratory infections (including tonsillitis), otitis media). Similarly, fetal deaths (stillbirths) and terminations of pregnancy are explored in more detail than has been the case in previous reports.

Ethnicity Classifications and Data Quality Issues

As previously, a number of data quality issues must also be taken into account when interpreting the information in this report. A number of these relate to the ethnicity classifications used and these are briefly summarised in the text box below. A more detailed review of these issues is also contained in the series of Sections / Appendices at the back of this report. The reader is urged to be aware of the contents of these when interpreting any of the data presented in this report.

Interpreting Ethnic Specific Rates and Trends: Data Quality Issues and Limitations

This report brings together routinely collected data on the health of Pacific children and young people in New Zealand. When interpreting this data, a number of limitations need to be taken into consideration:

1. *The Calculation of Ethnic Specific Rates*: The majority of rates calculated in this report have relied on the division of numerators (e.g. hospital admissions, mortality data) by Census or Birth Registration denominators. Calculation of accurate ethic specific rates relies on the assumption that information on ethnicity is collected in a similar manner in both the numerator and denominator and that a single child will be identified similarly in each. In New Zealand this has not always been the case, and even with the improvements in the collection of ethnicity data which have occurred over the past decade, there still remains the possibility the same individual will be identified differently in different data collections.

This is of particular concern in the context of reporting multiple ethnicities and has implications for the interpretation of differences between the Sole and (Any) Pacific groups highlighted in this report (e.g. if parents tend to identify children as having only a single Pacific identity in hospital admission data, but report multiple ethnic affiliations in the Census, this may potentially increase hospital admission rates for Sole Pacific children when compared with (Any) Pacific children). While the extent to which this actually occurs is difficult to quantify, the reader must nevertheless include data quality issues in the list of possible factors contributing to the differences between Sole and (Any) Pacific children and young people highlighted in this report. The Section on **Demography and the Measurement of Ethnicity** at the back of this report provides an overview of how ethnicity information has been collected over time in New Zealand's national data collections, and the various ethnicity classifications used in this report (Prioritised, Any and Sole Pacific). The reader is urged to review this section before interpreting any of the ethnic specific analyses presented.

2. *Changes in Uploading Emergency Department Cases to the Hospital Admission Dataset Over Time*: **Appendix 4** outlines a number of issues associated with the Hospital Admission Dataset, and in particular how changes in the way in which emergency department cases have been uploaded to the national minimum dataset can profoundly affect time series data for a number of conditions commonly dealt with in the emergency department setting (e.g. injuries, asthma, gastroenteritis). This problem is of particular importance for paediatric admissions in the Auckland region, and with nearly 2/3 of Pacific children and young people in New Zealand residing in Auckland, also has implications for the interpretation of Pacific child and youth health statistics. A more detailed overview of this issue is provided in **Appendix 4**, and the reader is strongly urged to read this Appendix before attempting to interpret any of the time series information on hospital admissions in this report.

3. *The Signalling of Statistical Significance*: **Appendix 1** outlines the rationale for the use of statistical significance testing in this report. In brief, all of the data in this report can be considered as belonging to one of two groups: Population Surveys (which use a sample to make inferences about the population as a whole) and Routine Administrative Datasets (which capture information on all events occurring in a particular category e.g. all deaths from a particular cause). The way in which each is handled for the purposes of statistical significance testing differs (as outlined in Appendix 1). In order to assist the reader to identify whether tests of statistical significance have been applied in a particular section, the Data Sources and Methods text box accompanying each indicator contains a small paragraph entitled Statistical Significance Testing, which either suggests that: 1) "Tests of statistical significance have not been applied to any of the data in this section, and thus any associations described do not imply statistical significance or non-significance"; OR 2) Tests of statistical significance (in the form of 95% confidence intervals) have been applied to some of the data in this section. Where relevant, the significance of these associations has been signalled in the text (with the words *significant* or *not significant* in italics being used to denote the statistical significance of the observed association). Where the words significant or non-significant do not appear in the text, then the associations described do not imply statistical significance or non-significance".

Concluding Comments

In addition to providing an overview of the health status of Pacific children and young people in New Zealand, this report aims to provide entry points into the policy / evidence based review literature, so that the health needs of children and young people can be addressed in a systematic and evidence based manner. In undertaking such a task however, epidemiological data and the findings of the policy / EBM literature are unlikely to be sufficient, with a number of additional elements also needing to be undertaken. These include:

1. *A Review of Services and Funding Currently Available*, with consideration being given to whether these services are effective / whether any can be discontinued in order to release funds for new initiatives. The availability of new funding and the likely budget implications over and above existing service delivery must also be considered from the outset.
2. *Consultation with Key Stakeholders (including Māori):* The views of key stakeholders are integral to any decision making process, as epidemiological data and the findings of evidence based reviews must always be considered alongside the views of those working with children and young people.

Thus, before considering any new initiatives to improve child and youth health, it is suggested that the Ministry of Health combine the epidemiological data in this report, with knowledge of existing services and key stakeholders' views. In addition, any approaches developed need also to be congruent with current Ministry of Health policy, and the evidence contained in the current literature. Finally, for those developing new approaches in areas where there is currently no sound evidence base, the plea is that they build into these programmes an evaluation arm, so that any learnings gained can be used by others to enhance the wellbeing of Pacific children and young people and to ensure the best use of available resources.

ISSUES MORE COMMON IN INFANCY

Fetal Deaths

Introduction

While stillbirths remain rare outcomes, they do provide a relatively hard outcome measure of maternity care [1]. As in most other developed countries, New Zealand's stillbirth rates have declined in recent decades [2], with the declines potentially being attributed to improvements in in-labour care; enhanced antenatal screening and the selective termination of fetuses with major congenital anomalies; and the early delivery of high risk pregnancies. Since the mid 1990s however, New Zealand's stillbirth rates have become static, with Pacific women continuing to experience higher rates of late fetal death (stillbirths 28+ weeks gestation) than other ethnic groups [3]. Because of the excess in stillbirths among Pacific communities, as well as the significant impact these deaths have on the families affected, the issue of stillbirth was selected by the Pacific Child and Youth Health Reference Group, for more in depth review in this report.

Aims, Objectives and Structure of this Review

The section which follows thus reviews the available New Zealand data, as well as the international literature on stillbirths with a view to:

1. Describing the distribution of stillbirths amongst Pacific groups in New Zealand
2. Identifying possible explanations for the higher stillbirth rates among Pacific communities.
3. Considering whether there are any evidence based, population level approaches which might be implemented by the health sector, to reduce the excess in stillbirth risk for Pacific women and their families.

In achieving these aims, the review begins by briefly summarising some of the terms used to define stillbirth in the international literature, before reviewing stillbirth rates amongst Pacific babies in New Zealand using data from the National Mortality Collection. The most common causes and risk factors for stillbirths are then reviewed using the New Zealand and international literatures, with a particular emphasis being placed on those risk factors which are more common in Pacific communities. The differences between unexplained and uninvestigated stillbirths and the role post-mortems play in this context are then highlighted, before possible approaches to preventing stillbirths are considered. It is hoped that the information contained in this review will be used by the health sector to develop prevention strategies which ultimately reduce the number of stillbirths experienced by Pacific women in New Zealand.

Stillbirth Definitions

Stillbirths are often defined as the "*Death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the foetus does not breathe or show any other evidence of life such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles*" (WHO 1977).

While controversy still exists as to the exact gestation at which a death is considered a fetal death rather than a spontaneous abortion, (some reviewers use 22 weeks [4] and others 24 weeks [5]), in New Zealand the convention has been to register all deaths of 28+ weeks completed gestation as late fetal deaths. In addition, since 1995 intermediate fetal deaths (20-27 weeks gestation) have also required both birth registration and death certification, making the transition point between spontaneous abortion and fetal death 20 weeks in this country [6].

Definitions

Intermediate Fetal Death: Fetal Death Occurring Between 20 and 27 Weeks Gestation

Late Fetal Death: Fetal Death Occurring at 28+ Weeks Completed Gestation

New Zealand Distribution and Trends

The following section briefly reviews the distribution of stillbirths in New Zealand using information available from the National Mortality Collection.

Data Sources and Methods

Definition

Intermediate Fetal Deaths: Fetal Deaths occurring between 20 and 27 weeks completed gestation
Late Fetal Deaths: Fetal Deaths occurring 28+ weeks completed gestation

Data Sources

Numerator: Death Registration Dataset (fetal deaths 20+ and 28+ weeks completed gestation as specified above). Cause of death assigned using a modification of the ONS Classification System (see Appendix 10).
Denominator: Birth Registration Dataset: All births 20+ and 28+ weeks completed gestation as specified above. For gestational age specific rates, the denominator was those remaining in utero at the specified gestational age (e.g. the 22 week denominator excludes all births occurring at 20 and 21 weeks….)

Notes on Interpretation

Note 1: Death Registration data does not differentiate between spontaneous fetal deaths and late terminations of pregnancy (all fetal deaths 20+ weeks gestation require death registration). The admixture of spontaneous and induced fetal deaths is likely to be most prominent at earlier gestations (e.g. the high number of deaths attributed to congenital anomalies prior to 25 weeks gestation). In addition, information on intermediate fetal deaths is only available from 1995 (when the age of death registration moved from 28+ weeks to 20+ weeks)

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category Ideal B

Distribution by Cause

Any and Sole Pacific vs. New Zealand: During 2001-2005, using a modified version of the ONS Classification System (see Appendix 10), congenital anomalies were the leading cause of intermediate fetal death for Any Pacific babies, followed by those for whom the cause of death was unspecified (i.e. the listed fetal cause was ICD10 P95 or R99 (Unspecified) and no contributing maternal causes were recorded). In interpreting these figures however, it must be remembered that all fetal deaths 20+ weeks gestation (including those arising from late terminations of pregnancy) appear in death registration data. Thus it is difficult to distinguish between spontaneous fetal deaths, and those dying as the result of a termination (e.g. for major congenital anomalies). For late fetal deaths, the leading cause of death was unspecified, followed by those dying as a result of asphyxia, anoxia or trauma (either during the antepartum period or labour). While a similar profile was seen for New Zealand as a whole, for Sole Pacific babies, unspecified causes were the leading cause of both intermediate and late fetal death (**Table 2**).

New Zealand Trends

In New Zealand during 1996-2005, large year to year variations meant trends in intermediate fetal deaths were difficult to interpret. While variations in late fetal deaths were less marked, rates declined only marginally during 1988-2005. The proportion of deaths due to unspecified causes remained relatively constant throughout this period (**Figure 1**).

Distribution by Gestational Age

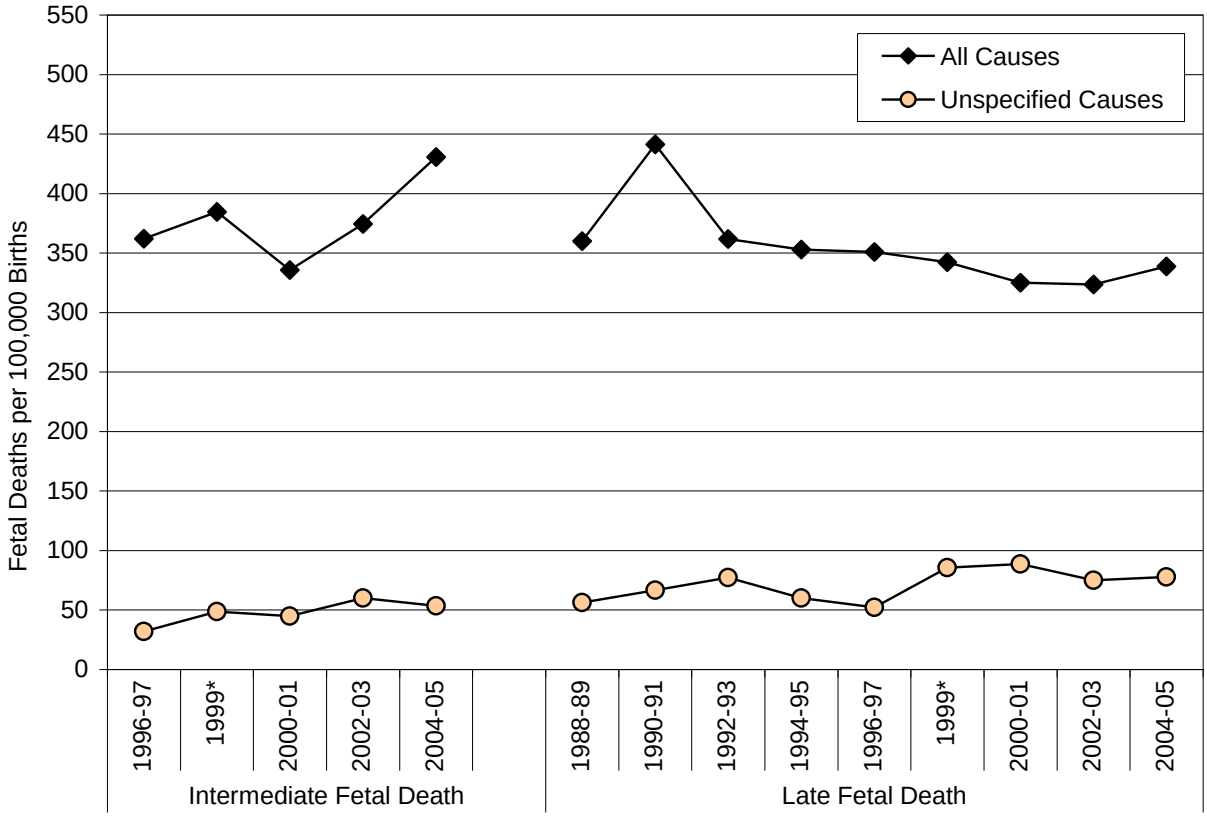
In New Zealand during 2001-2005, fetal deaths exhibited a U-shaped distribution by gestational age, with rates being high amongst those <25 weeks, lower during mid-gestation and then rising again rapidly at term. In interpreting these figures it must be remembered that rates were calculated by dividing the number of fetal deaths at each gestational age by the number of babies remaining in utero. Thus, while the absolute number of babies dying in utero did not rise exponentially towards term, the risk for those remaining in utero increased markedly (e.g. while 26 asphyxia deaths occurred at 40 weeks but only 20 at 41 weeks, asphyxia mortality rates rose between 40 and 41 weeks, due to the much smaller number of babies remaining in utero). In addition, it was not possible to distinguish between spontaneous fetal deaths and late terminations of pregnancy, and thus the high mortality rates (e.g. from congenital anomalies) amongst those <25 weeks must be interpreted with this in mind (**Figure 2**).

Table 2. Fetal Deaths by Baby's Ethnicity and Cause, New Zealand 2001-2005

Cause of Death*	Intermediate Fetal Death			Late Fetal Death		
	Total: 2001-05	Rate per 100,000	% of Total	Total: 2001-05	Rate per 100,000	% of Total
Any Pacific						
Congenital Anomalies	37	86.30	23.7	22	51.76	13.0
Unspecified Cause of Death	33	76.97	21.2	57	134.09	33.7
Asphyxia, Anoxia, or Trauma**	7	16.33	4.5	28	65.87	16.6
Antepartum Infections	6	13.99	3.8	<5	s	s
Other Specific Conditions	7	16.33	4.5	7	16.47	4.1
Other Conditions**	66	153.93	42.3	51	119.98	30.2
Total	156	363.84	100.0	169	397.57	100.0
Sole Pacific						
Congenital Anomalies	14	72.15	16.3	14	72.71	14.4
Unspecified Cause of Death	23	118.53	26.7	30	155.81	30.9
Asphyxia, Anoxia, or Trauma**	5	25.77	5.8	17	88.29	17.5
Antepartum Infections	<5	s	s	<5	s	s
Other Specific Conditions	5	25.77	5.8	<5	s	s
Other Conditions**	35	180.37	40.7	31	161.01	32.0
Total	86	443.19	100.0	97	503.79	100.0
New Zealand						
Congenital Anomalies	389	135.84	34.5	120	42.26	12.8
Unspecified Cause of Death	163	56.92	14.5	242	85.22	25.7
Asphyxia, Anoxia, or Trauma**	69	24.10	6.1	192	67.61	20.4
Antepartum Infections	37	12.92	3.3	14	4.93	1.5
Other Specific Conditions	63	22.00	5.6	54	19.02	5.7
Other Conditions**	406	141.78	36.0	319	112.33	33.9
Total	1,127	393.56	100.0	941	331.36	100.0

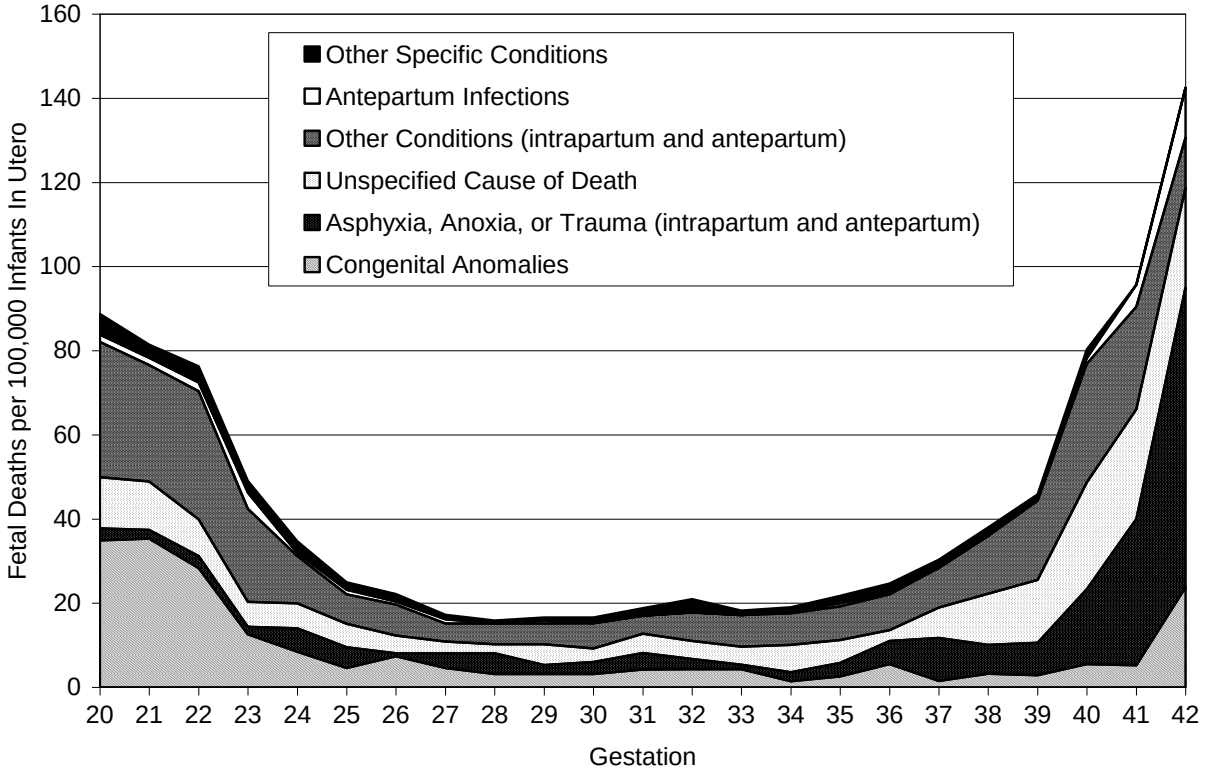
Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Note: Cause of Death Assigned Using a Modified Version of the ONS Classification System (See Appendix 10); Intermediate fetal deaths may include a number of late terminations of pregnancy; **Includes both intrapartum and antepartum.

Figure 1. Intermediate (1996-2005) and Late (1988-2005) Fetal Deaths, New Zealand



Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset. Note: Data on Intermediate Fetal Deaths only available from 1996. Rates for 1998 excluded as gestation specific denominators unavailable.

Figure 2. Fetal Deaths by Gestational Age and Cause, New Zealand 2001-2005



Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset: Note: Rate calculated by dividing the number of fetal deaths by the number of babies remaining in utero; Rates may also include a number of deaths arising from late terminations of pregnancy)

Distribution by Prioritised Ethnicity, NZDep, Gender and Rural Urban Location

In New Zealand during 2001-2005, intermediate fetal deaths were similar for European, Māori and Pacific babies. Rates for Asian babies however, were *significantly higher* than for European babies. Rates were *not significantly different* by gender, NZDep or rural / urban location (**Table 3**). In contrast, late fetal deaths were *significantly higher* for Pacific babies than for European and Māori babies. Rates were also *significantly higher* for those living in the most deprived areas (**Table 4**).

Risk Factors for Unspecified Fetal Deaths

In New Zealand during 2001-2005, unspecified fetal deaths (where the fetal cause of death was listed as ICD10 P95 or R99 (Unspecified) and no additional maternal causes were recorded) were *significantly higher* for Pacific and Māori > European babies and those living in the more deprived areas (**Table 5**).

Table 3. Risk Factors for Intermediate Fetal Death, New Zealand 2001-2005

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	370.41	1.00		1-2	377.30	1.00	
2	383.56	1.04	0.76 - 1.40	3-4	347.18	0.92	0.74 - 1.14
3	300.45	0.81	0.59 - 1.12	5-6	369.71	0.98	0.80 - 1.20
4	388.24	1.05	0.78 - 1.41	7-8	432.80	1.15	0.95 - 1.39
5	386.72	1.04	0.77 - 1.41	9-10	428.60	1.14	0.94 - 1.37
6	355.60	0.96	0.72 - 1.29	Baby's Prioritised Ethnicity			
7	499.28	1.35	1.02 - 1.78	European	389.90	1.00	
8	379.22	1.02	0.77 - 1.35	Māori	382.14	0.98	0.85 - 1.13
9	411.37	1.11	0.84 - 1.46	Pacific	366.97	0.94	0.77 - 1.15
10	443.50	1.20	0.92 - 1.56	Asian	480.14	1.23	1.01 - 1.50
Gender				Urban / Rural			
Female	375.22	1.00		Urban	401.86	1.00	
Male	403.56	1.08	0.96 - 1.21	Rural	341.96	0.85	0.71 - 1.02

Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Note: Rate per 100,000 births per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Table 4. Risk Factors for Late Fetal Death, New Zealand 2001-2005

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	224.57	1.00		1-2	238.97	1.00	
2	252.06	1.12	0.76 - 1.65	3-4	343.54	1.44	1.13 - 1.84
3	329.31	1.47	1.02 - 2.11	5-6	320.75	1.34	1.05 - 1.71
4	356.04	1.59	1.12 - 2.25	7-8	318.68	1.33	1.05 - 1.69
5	326.33	1.45	1.01 - 2.09	9-10	402.25	1.68	1.35 - 2.10
6	316.13	1.41	0.99 - 2.00	Baby's Prioritised Ethnicity			
7	330.01	1.47	1.03 - 2.09	European	312.22	1.00	
8	309.55	1.38	0.98 - 1.94	Māori	316.56	1.01	0.87 - 1.18
9	403.75	1.80	1.29 - 2.50	Pacific	450.93	1.44	1.19 - 1.75
10	400.95	1.79	1.29 - 2.47	Asian	352.16	1.13	0.90 - 1.42
Gender				Urban / Rural			
Female	324.92	1.00		Urban	336.30	1.00	
Male	337.51	1.04	0.91 - 1.18	Rural	301.52	0.90	0.74 - 1.09

Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Note: Rate per 100,000 births per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Table 5. Risk Factors for Fetal Deaths of Unspecified Cause, New Zealand 2001-2005

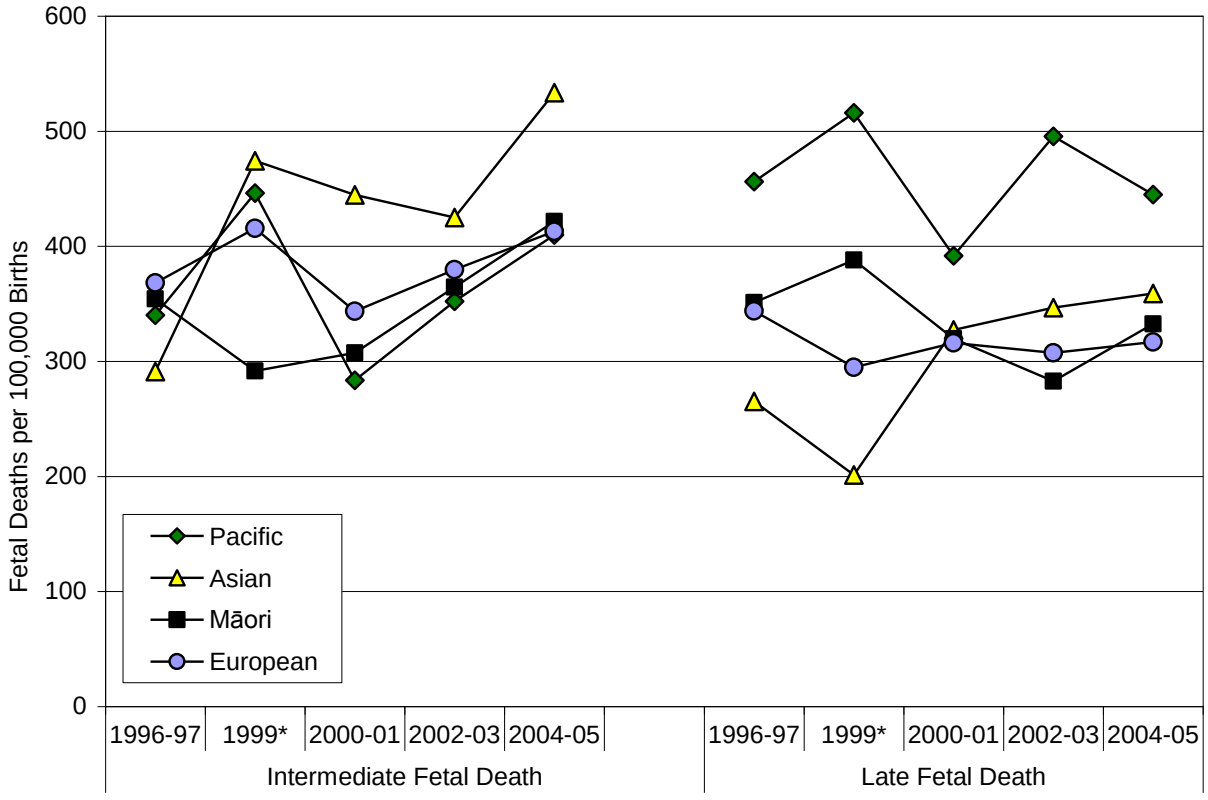
Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	85.48	1.00		1-2	122.00	1.00	
2	155.15	1.82	1.03 - 3.20	3-4	126.06	1.03	0.72 - 1.49
3	114.88	1.34	0.74 - 2.45	5-6	108.63	0.89	0.61 - 1.29
4	135.89	1.59	0.90 - 2.81	7-8	150.68	1.24	0.88 - 1.73
5	121.90	1.43	0.79 - 2.57	9-10	181.63	1.49	1.09 - 2.04
6	97.62	1.14	0.63 - 2.06	Baby's Prioritised Ethnicity			
7	140.09	1.64	0.94 - 2.86	European	113.75	1.00	
8	159.21	1.86	1.09 - 3.17	Māori	168.04	1.48	1.18 - 1.85
9	149.33	1.75	1.02 - 2.98	Pacific	222.12	1.95	1.48 - 2.58
10	209.57	2.45	1.48 - 4.07	Asian	130.95	1.15	0.79 - 1.67
Gender				Urban / Rural			
Female	133.65	1.00		Urban	141.60	1.00	
Male	144.76	1.08	0.89 - 1.32	Rural	141.59	1.00	0.75 - 1.33

Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Note: Rate per 100,000 births per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Trends in Fetal Deaths by Prioritised Ethnicity

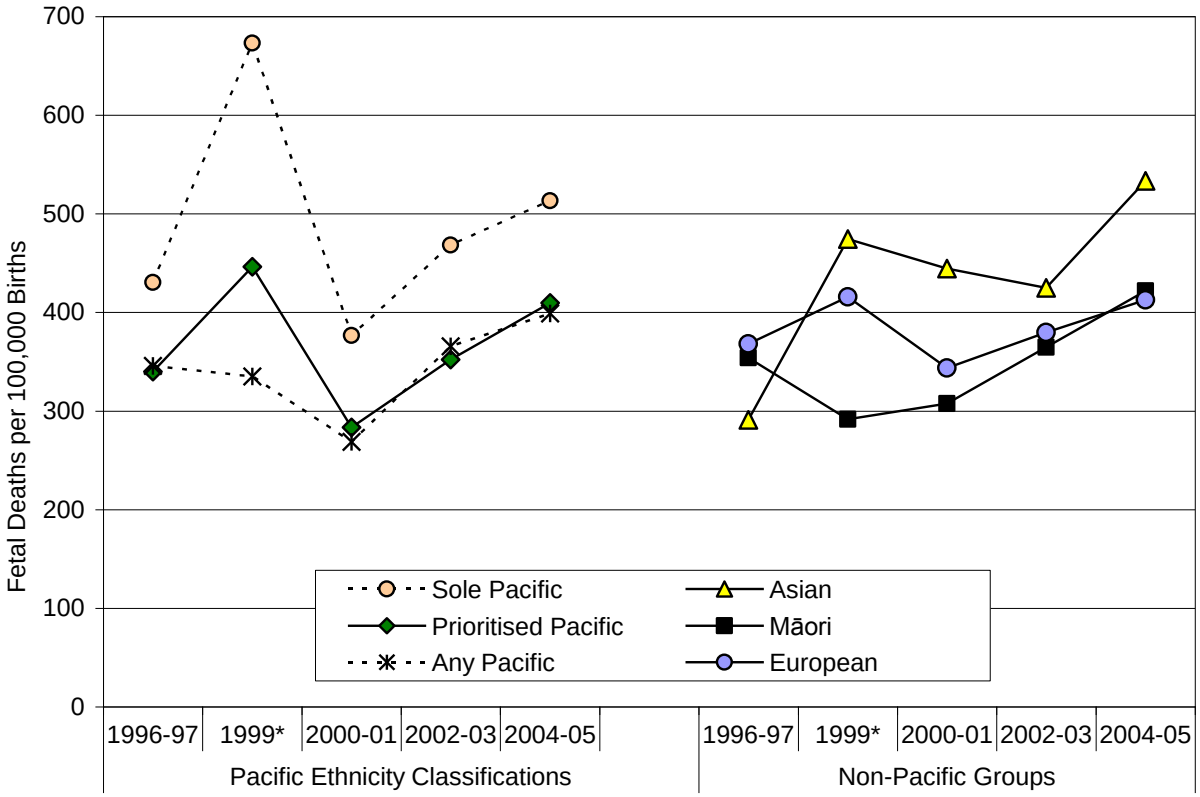
In New Zealand during 1996-2005, late fetal deaths were consistently higher for Pacific babies than for babies from other ethnic groups, while intermediate fetal deaths were higher for Asian babies during 1999-2005 (**Figure 3**). Intermediate and late fetal deaths were also higher for Sole than for Any Pacific babies during this period (**Figure 4**, **Figure 5**).

Figure 3. Intermediate and Late Fetal Deaths by Baby's Ethnicity, New Zealand 1996-2005



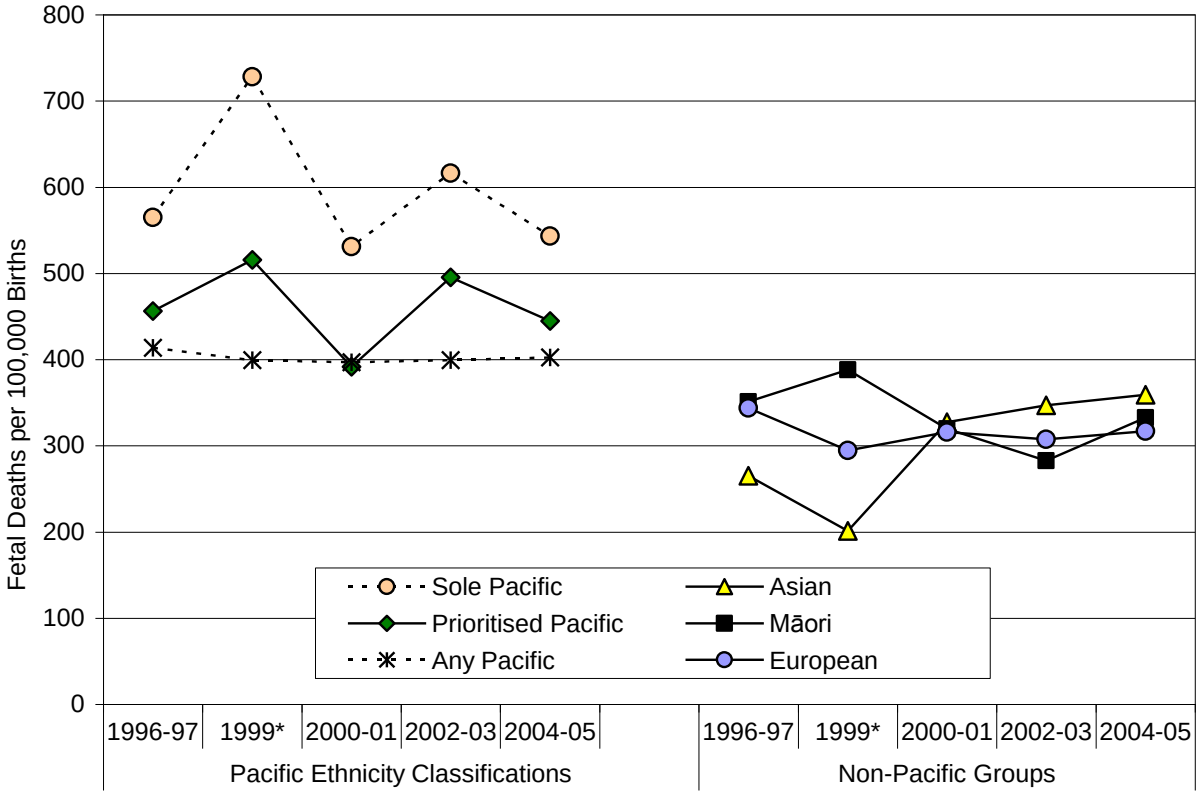
Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Note: Data for 1998 excluded as gestation specific denominators unavailable; Ethnicity is Level 1 Prioritised

Figure 4. Intermediate Fetal Deaths by Baby's Ethnicity, New Zealand 1996-2005



Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Note: Data for 1998 excluded as gestation specific denominators unavailable. Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 5. Late Fetal Deaths by Baby's Ethnicity, New Zealand 1996-2005



Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Note: Data for 1998 excluded as gestation specific denominators unavailable. Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Distribution by Cause and Post Mortem

During 2001-2005, “unspecified causes” was the leading cause of fetal death (intermediate and late fetal combined) for Sole and Any Pacific babies, followed by congenital anomalies. For both Sole and Any Pacific babies, the proportion undergoing post-mortem varied markedly by cause, with babies dying from antepartum infections having the highest post mortem rates, while babies dying from unspecified causes had the lowest. In interpreting these figures however, it is difficult to determine whether the cause of death influenced the probably of undergoing post mortem (e.g. the presence of major congenital anomalies may have reduced the likelihood of post mortem), or whether post mortems resulted in the differential assignment of deaths to particular causes (e.g. the high post mortem rate in the antepartum infections category potentially suggests that post mortems may have identified previously unrecognised infections as a cause of death). Finally, the low post mortem rate in those with unspecified causes potentially suggests that this category may have included both those whose death was truly unexplained, as well as those which were merely uninvestigated (**Table 6**).

Table 6. Intermediate and Late Fetal Deaths (Combined) by Cause of Death and Proportion Undergoing Post Mortem, Any and Sole Pacific vs. New Zealand Babies 2001-2005

Cause of Death*	Fetal Deaths		Post Mortems	
	Total Number 2001-05	% of Total Fetal Deaths	Total Number 2001-05	% of Category Undergoing Post-Mortem
Any Pacific				
Unspecified Cause of Death	91	27.9	7	7.7
Congenital Anomalies	59	18.1	31	52.5
Asphyxia, Anoxia, or Trauma**	35	10.7	22	62.9
Antepartum Infections	10	3.1	9	90.0
Other Specific Conditions	14	4.3	7	50.0
Other Conditions**	117	35.9	22	18.8
Total	326	100.0	98	30.1
Sole Pacific				
Unspecified Cause of Death	53	29.0	5	9.4
Congenital Anomalies	28	15.3	17	60.7
Asphyxia, Anoxia, or Trauma**	22	12.0	14	63.6
Antepartum Infections	5	2.7	5	100.0
Other Specific Conditions	9	4.9	5	55.6
Other Conditions**	66	36.1	7	10.6
Total	183	100.0	53	29.0
New Zealand				
Unspecified Cause of Death	405	19.6	88	21.7
Congenital Anomalies	509	24.6	267	52.5
Asphyxia, Anoxia, or Trauma**	261	12.6	170	65.1
Antepartum Infections	51	2.5	42	82.4
Other Specific Conditions	117	5.7	64	54.7
Other Conditions**	725	35.1	210	29
Total	2,068	100.0	841	40.7

Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); *Modified ONS classification (see Appendix 10) used to assign cause of death; **Includes both intrapartum and antepartum.

Table 7. Distribution of Intermediate and Late Fetal Deaths by Pacific Group, New Zealand 2001-2005

Any Pacific										
Pacific Group	Intermediate Fetal Deaths					Late Fetal Deaths				
	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Any Samoan	81	16.2	374.0	0.93	0.74-1.17	84	16.8	387.9	1.23	0.98-1.55
Any Tongan	27	5.4	279.8	0.69	0.47-1.02	34	6.8	352.4	1.12	0.79-1.59
Any Cook Island Māori	32	6.4	320.0	0.79	0.56-1.13	29	5.8	290.0	0.92	0.64-1.34
Any Niuean	18	3.6	489.7	1.21	0.76-1.94	16	3.2	435.3	1.39	0.84-2.28
Any Fijian	8	1.6	603.8	1.50	0.75-3.00	14	2.8	1056.6	3.36	1.98-5.70
Any Tokelauan	0	0	0.0	s	s	<5	s	s	s	s
Any Other Pacific	<5	s	s	s	s	8	1.6	569.4	1.81	0.90-3.64
Any Pacific	156	31.2	363.6	0.90	0.76-1.07	169	33.8	393.9	1.25	1.06-1.49
Any Māori	307	61.4	381.5	0.95	0.83-1.08	252	50.4	313.2	1.00	0.86-1.16
Non-Māori Non-Pacific	706	141.2	403.2	1.00		550	110	314.1	1.00	
Sole Pacific										
Pacific Group	Intermediate Fetal Deaths					Late Fetal Deaths				
	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Sole Samoan	50	10	513.0	1.27	0.96-1.69	51	10.2	523.3	1.67	1.25-2.22
Sole Tongan	16	3.2	313.2	0.78	0.47-1.27	22	4.4	430.7	1.37	0.90-2.10
Sole Cook Island Māori	11	2.2	395.0	0.98	0.54-1.78	10	2	359.1	1.14	0.61-2.13
Sole Niuean	<5	s	s	s	s	6	1.2	1087.0	3.46	1.55-7.70
Sole Fijian	<5	s	s	s	s	<5	s	s	s	s
Sole Tokelauan	0	0	s	s	s	0	0	0.0	s	s
Sole Other Pacific	<5	s	s	s	s	5	1	709.2	2.26	0.94-5.43
Sole Pacific	86	17.2	442.9	1.10	0.88-1.37	97	19.4	499.6	1.59	1.28-1.97
Sole Māori	144	18	442.6	1.10	0.92-1.31	132	26.4	405.7	1.29	1.07-1.56
Non-Māori Non-Pacific	706	141.2	403.2	1.00		550	110	314.1	1.00	

Source: Numerator-National Mortality Collection; Denominator- Birth Registration set. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); RR: Rate ratios are compared to the Non-Māori Non-Pacific group and are unadjusted.

Distribution of Stillbirths Amongst Pacific Groups in New Zealand

Distribution by Pacific Group

During 2001-2005 (using the Sole / Any Classification), intermediate fetal deaths for babies in each of the Sole and Any Pacific groups were *not significantly different* from non-Māori non-Pacific babies (with the exception of Tokelauan and Other Pacific babies and Sole Fijian and Niuean babies, where small numbers precluded a valid analysis). In contrast, late fetal death rates for Sole and Any Pacific babies as a whole were *significantly higher* than for non-Māori non-Pacific babies, although within the individual Pacific groups, rates were only *significantly higher* for Sole Samoan and Niuean babies and Any Fijian babies (**Table 7**).

Summary: New Zealand Distribution and Trends

During 2001-2005, congenital anomalies were the leading cause of intermediate fetal death for Any Pacific babies, followed by those for whom the cause of death was unspecified. For late fetal deaths, the leading cause was unspecified, followed by those dying as a result of asphyxia, anoxia or trauma. For Sole Pacific babies however, unspecified causes were the leading cause of both intermediate and late fetal death. When broken down by gestational age, fetal deaths exhibited a U-shaped distribution, with rates being high <25 weeks, lower in mid-gestation and then rising again as term approached. While intermediate fetal deaths were similar for European, Māori and Pacific babies, rates were *significantly higher* for Asian babies. In contrast, late fetal deaths were *significantly higher* for Pacific babies and those in the most deprived areas, while unspecified fetal deaths were *significantly higher* for Pacific and Māori babies and those in more deprived areas.

During 2001-2005 (using the Sole / Any Classification), intermediate fetal deaths for babies each of the Sole and Any Pacific groups were *not significantly different* from non-Māori non-Pacific babies (with the exception of Tokelauan and Other Pacific babies and Sole Fijian and Niuean babies, where small numbers precluded a valid analysis). In contrast, late fetal death rates for Sole and Any Pacific babies as a whole were *significantly higher* than for non-Māori non-Pacific babies, although within the individual Pacific groups, rates were only *significantly higher* for Sole Samoan and Niuean babies and Any Fijian babies.

Causes and Risk Factors for Stillbirth

Having reviewed the distribution of stillbirths in the New Zealand context, the following section reviews the main causes of / and risk factors for stillbirth as identified in the international literature, before considering possible approaches to reducing stillbirths amongst Pacific women in New Zealand.

Causes and Risk Factors

There are a number of recognised **Causes** of fetal death where the precise pathway is well understood e.g. placental abruption, maternal or fetal trauma.

There are a number of maternal and fetal **Risk Factors** associated with fetal deaths where the causal pathways are less clear, or where the outcomes are variable e.g. smoking, maternal obesity, diabetes

There remains controversy over the distinction between risk factors and 'definite causes' of stillbirth, with some classifications e.g. including fetal growth restriction as a cause and some as a risk factor

In a large proportion of fetal deaths, the cause of death remains **Unexplained**

Within the developed world stillbirth rates are estimated to be between 4.2-6.8/1000 births [7]. Stillbirth can be the end result of a number of different pathological pathways. There are a number of recognized causes of fetal death which include congenital anomalies, infection, Rh isoimmunisation, maternal and fetal trauma, as well as asphyxia due to a number of pathways including pre eclampsia, placental abruption and umbilical cord accidents [7].

In addition to these causes of fetal death there are also a number of maternal and fetal factors which are associated with fetal death where the causal pathways are less clear and fetal outcomes more variable. There remains some controversy over the distinction between risk factors and 'definite causes' of stillbirth. For example some classification systems now

consider fetal growth restriction to be a cause of fetal demise even though the exact pathway leading to poor fetal growth (and ultimately death) is often not well understood [8, 9].

Maternal risk factors associated with stillbirth include smoking, maternal obesity, advanced maternal age, diabetes mellitus, low socioeconomic status, parity and ethnicity [10-12]. Despite having identified a number of risk factors for stillbirth, as well as understanding some of the direct causes of stillbirth, there remain a large proportion of fetal deaths where the cause of death is unexplained. The following sub-sections describe the recognized causes and risk factors for stillbirth. The majority of the studies discussed in this section relate to all stillbirths (including unexplained, early and late) unless otherwise stated.

Causes of Stillbirth

Known Causes of Stillbirth:
The most common causes of stillbirth are:

Placental Abruption:	Accounts for 10-19% of Stillbirths The placenta may prematurely separate from the uterus for a variety of reasons
Infections:	Accounts for 10-25% of Stillbirths Fetal infection by bacterial, protozoal or viral agents Preterm fetal death more likely to be caused by infection than fetal deaths that occur at term or post term Difficult to prevent
Congenital Anomalies	Accounts for approximately 10% of Stillbirths Increases in antenatal screening and selective terminations have lead to a decrease in late fetal deaths from congenital anomalies

Other Conditions Associated with Stillbirths Include:

Thrombophilia, Systemic Lupus Erythematosis (SLE), Antiphospholipid syndrome (APS), Umbilical cord accidents, Obstetric complications, Placental Pathology, Rhesus Isoimmunisation, Maternal and fetal trauma, Umbilical cord accidents, Pre eclampsia

The most common causes of stillbirth are placental abruption, congenital malformations and intrauterine infections [8, 13], each of which will be briefly reviewed in turn. There are also a number of medical conditions which predispose to stillbirth, which are primarily managed by obstetricians, and it is beyond the scope of this review to discuss their detailed clinical management. Deaths due to isoimmunisation are now exceeding rare (due to improvements in isoimmunisation-Rh immune prophylaxis [13]), and will not be discussed further in this section.

Placental Abruption

Placental abruption has been found to complicate approximately 1% of deliveries [14] and it has been estimated that 10-19% of stillbirths result from abruption [15] making it one of the more common known causes of fetal death [13]. Placental Abruption is an obstetric complication that occurs when the placenta prematurely separates from the uterus and can result in fetal and / or maternal death. The classic signs and symptoms of placental abruption include vaginal bleeding, back pain, fetal distress, and hypertonic uterus or tetanic contractions [14]. A number of risk factors have been identified for abruption and include abruption in a prior pregnancy, multiparity, advanced maternal age, maternal hypertensive disorders, polyhydramnios, chorioamnionitis, premature rupture of membranes, uterine leiomyomas, cocaine and tobacco use, poor nutrition, trauma, hyperthyroidism and possibly thrombophilias [14]. In most cases however the cause of abruption is unknown. It has been speculated that there may be a genetic contribution to the risk of placental abruption because of the high recurrence rate, high prevalence of thrombophilia among women with abruption, and a higher risk in families having an index patient with abruption [14].

Infection

Bacterial, protozoal and viral infections have long been recognized as a cause of intrauterine fetal demise [9]. In developed countries infections have been estimated to be responsible for

10-25% of stillbirths [15]. In an Australian study using the Perinatal of Society of Australia and New Zealand Perinatal death classification system, infection was found to be the causal agent in 5.5% of stillbirths that underwent post-mortem investigation [8]. Preterm fetal death is more likely to be caused by infection than fetal deaths that occur at term or post term [15]. One study found that 19% of premature fetal deaths were due to infection compared to 2% of fetal deaths >28 weeks [16]. Similarly a large Canadian study found that 19% of stillbirths 24-27 weeks were due to infection [13]. This study also found that fetal deaths rates from infection remained static over three decades despite increased use of antibiotics [13].

Infection can result in stillbirth by several mechanisms including direct infection of the fetus, placental damage and severe maternal illness [17]. The most common bacterial infections identified are E. Coli, group B Streptococcus and Ureaplasma Urealyticum [15]. Toxoplasmosis and listeria are also associated with stillbirth, as are malaria and syphilis [15]. There is some uncertainty however, about the proportion of stillbirths caused by viral infections for a number of reasons including [15]:

1) Failure to test systematically for viral infections in stillbirths
2) Technical difficulties with culturing viruses
3) Uncertainty of the significance of positive findings (colonization vs. infection)

Because of this it is possible that more fetal deaths are caused by viral infections than currently recognized. Maternal infection with vaccine preventable viral illnesses such as chickenpox, rubella, measles and mumps are also associated with fetal loss [15]. There is also good evidence that fetal infection with parvovirus, cytomegalovirus and enteroviruses (such as coxsachie) can cause fetal death, although it should be noted that maternal infection does not always impact negatively on the fetus [9, 15].

Congenital Abnormalities

Congenital abnormalities are one of the most frequent known causes of fetal death and cover a spectrum of conditions which are mediated through a variety of pathways. Congenital abnormalities can result from chromosomal abnormalities, metabolic disorders (e.g. glycogen storage diseases, hemoglobinopathies), fetal disruptions or dysplasias or, as discussed below, poor maternal glycaemic control [18]. In one study Smith et al found that 10% of all fetal deaths were classified as arising from a fetal abnormality using a modified Wigglesworth classification system [7]. Similarly a study using the Perinatal Society of Australia and New Zealand Perinatal death classification found 10.1% of fetal deaths >20 weeks and/or ≥400g were caused by congenital malformations [8].

Early perinatal diagnostic testing has lead to a reduction in fetal deaths and infant mortality from congenital abnormalities. The rate of fetal deaths due to lethal abnormalities decreased significantly between the 1970s and 1980s due mainly to the early identification of anencephalic fetuses and subsequent early termination [13]. Similarly, a Canadian study investigating the impact of changes in perinatal care on infant mortality from congenital anomalies between 1981-1995 found that mortality from major congenital anomalies decreased from 3.11 per 1, 000 live births in 1981 to 1.89 per 1,000 live births in 1995 [19]. Reductions varied by condition, with significant decreases in mortality from anencephaly, spina bifida, cardiovascular, digestive system, musculoskeletal anomalies, urinary and multiple congenital anomalies. These declines were attributed to both an increase in antenatal diagnosis and termination of fetuses with identified anomalies, as well as improvements in surgical management of some conditions [19].

Another Canadian birth cohort study also investigated changes in congenital anomaly related fetal and infant deaths [20]. The authors found that there were large increases in fetal deaths from congenital anomalies at 20 to 21 weeks' gestation in 1994, as well as large increases in terminations at 20-21 weeks gestation in 1995. (It should be noted however, that increases in terminations undertaken ≥20 weeks may underestimate the impact of perinatal diagnosis on fetal and infant outcomes, as the majority of prenatal diagnosis and selective termination occurs prior to 20 weeks gestation [20]). The same study also found that the increases in fetal deaths from congenital anomalies at earlier gestations were accompanied by decreases in

fetal deaths at later gestations, with rates at 28-36 weeks decreasing from 23.9 per 100,000 in 1991, to 15.3 per 100,000 in 1998. There was also a decline in overall infant mortality which was associated with a reduction in infant deaths due to congenital anomalies [20]. The authors concluded that the increased utilization of prenatal diagnosis and selective termination of fetuses with congenital abnormalities impacted perceptively on infant mortality rates.

Other Causes

A number of other causes are known to be associated with an increased risk of fetal death. **Thrombophilias** have been shown to increase the risk of fetal death, particularly at late gestations [9]. One recent meta-analysis estimated that women with factor V leiden mutation were twice as likely to experience an early fetal loss and 7.8 times more likely to experience a late fetal loss than women without such a mutation [15]. Similarly, women with a prothrombin gene mutation were 2.6 time more likely to experience an early recurrent loss, while women with a protein S deficiency were 3.5 times more likely to suffer a recurrent fetal loss compared to women without such mutations [15]. However, Silver notes that two large prospective cohort studies indicate no association between factor V Leiden mutation and heritable thrombophilias, and fetal loss or obstetric complications due to placental insufficiency [15]. Silver argues that the lack of evidence from prospective studies suggests that thrombophilia is unlikely to cause pregnancy loss in women with thrombophilia and women with no prior obstetric complications should be reassured [15].

Systemic Lupus Erythematosis (SLE) affects <1% of pregnancies but confers a high risk of stillbirth, especially in women with pre existing renal disease. These women often have a number of other risk factors for stillbirth including hypertension, preeclampsia and fetal growth restriction. Approximately 3-8% of pregnancies in women with SLE will end in fetal death [9].

Antiphospholipid Syndrome (APS) has been estimated to cause pregnancy loss in about 5-10% of women with recurrent miscarriage [15]. The condition is characterized by antiphospholipid antibodies and 1+ clinical feature(s) including: pregnancy loss, thrombosis or autoimmune thrombocytopenia. It is not certain what the underlying mechanism is that leads to fetal loss in these women but it has been hypothesized that it relates to inflammation, thrombosis and infarction of the placenta [15]

Umbilical Cord Accidents refer to fetal deaths attributed to cord occlusion, which may occur as the result of true knots, nuchal cords or cord compression. Nuchal cords are often present in normal pregnancies and it is difficult to be certain about the number of stillbirths that truly arise from cord complications [15].

There are a number of other **Obstetric Complications** that can cause stillbirths. These include preeclampsia, preterm premature rupture of membranes, preterm labour, cervical insufficiency, placenta previa and vasa previa [15].

Summary: Causes of Stillbirth

As the above review suggests, there are a number of well recognised causes of stillbirth. In addition, improved antenatal screening for congenital anomalies and the selective termination of affected fetuses has resulted in large decreases in fetal and infant deaths from congenital anomalies in recent years. Little progress however, has been made in decreasing the number of stillbirths arising from infections despite the increased use of antibiotics, as many infectious agents are ubiquitous in the environment, and exposure can be difficult to avoid. Similarly, other obstetric causes of stillbirth (e.g. placental abruption) can be difficult to anticipate, with early recognition and appropriate management of known risk factors remaining the mainstay of management for these women.

Risk Factors for Stillbirth

Known Risk Factors for Fetal Death

There are a number of well established risk factors for stillbirths which include:

Maternal Smoking	Smoking is a well established risk factor for stillbirths Risk is mediated through growth restriction and placental pathology
Obesity	The prevalence of obesity is increasing in women of childbearing age Obesity is an independent risk factor for stillbirth The risk of stillbirth increases with increasing obesity The mechanism by which obesity increases risk is not well understood
Diabetes	Poor glycaemic control is associated with an increased risk of congenital anomalies and stillbirth Ideally diabetes should be diagnosed prior to pregnancy to allow for optimal glycaemic control prior to conception and during early pregnancy Pacific women make up a large proportion of women in Auckland diagnosed with Type II diabetes during pregnancy
SES	Low socioeconomic status is an established risk factor for stillbirth, although the pathways via which this occurs remain unclear
Ethnicity	While the precise pathways remain unclear, the association between ethnicity and stillbirth may be in part due to the clustering of other risk factors for stillbirth in particular ethnic groups
Maternal Age	Advanced maternal age is a risk factor for stillbirth Mechanisms by which advanced maternal age may increase stillbirth risk include; increasing utilisation of reproductive technologies, increased risk of congenital anomalies, poor uterine vasculature
Multiple Births	Increased risk of fetal death in multiples is due to complications specific to multiple pregnancy (e.g. twin to twin transfusion) as well as increase risk of fetal anomalies and growth restriction.
Drug Use	There is conflicting evidence whether alcohol, methamphetamine and cocaine increase stillbirth risk. Marijuana does not appear to increase risk
Growth Impairment	Strong association between fetal growth restriction and stillbirth Use of customised percentile charts help make distinctions between normal and abnormal fetal growth

Maternal Smoking

Smoking is a well established risk factor for poor reproductive outcomes [21], and is likely to be causal for stillbirth given there is both a strong dose-response curve and biological plausibility for such an effect [11, 18]. Smoking causes elevated levels of fetal carboxyhemoglobin, and also increases vascular resistance through vasoconstriction, both of which lead to decrease tissue oxygenation and subsequently decreased fetal growth [15].

A number of studies have shown that poor fetal growth, combined with the increase risk of placental abnormalities such as placenta previa and placental abruption in women who smoke, accounts for the increase risk of stillbirths in smokers. Gardosi et al reviewed the characteristics of third trimester fetal deaths and found that mothers with stillborn babies were more likely to have smoked during pregnancy (OR 1.61 (95% CI 1.16-2.25)) [22]. Raymond et al examined the effects of advanced maternal age, nulliparity and smoking on the risk of stillbirths and found that the association between smoking and fetal death could be completely explained by the increase in placental abruption, placental previa and growth restriction [15, 23]. Cnattinggius and Lambe (2002) used information from the population based Swedish Medical Birth Register to investigate the impact of smoking on pregnancy outcomes and found that after adjusting for maternal age, cohabitation with infant's father, maternal education, mother's country of birth and maternal height, that smoking ≥10 cigarettes/day almost doubled the risk of stillbirth (adjusted OR 1.8 (95% CI1.5-2.2)) [24]. Similarly, McCowan et al compared a cohort of 437 stillborn babies (>20 weeks gestation) born during 1993-2000 at National Women's Hospital in Auckland with 69173 live births during the same period. They found that while smoking was not significantly associated with stillbirth (adjusted OR 1.33 95% CI 0.99-1.79) [25], where smoking status was unknown the risk of stillbirth was significantly

increased (OR 2.87 95% CI 2.31-3.58). The authors speculated that this group may have represented the heaviest smokers in the cohort [25].

Froen et al looked specifically at sudden unexplained intrauterine death (SUID) and found that while heavy maternal smoking (>10 cigarettes/day) was associated with an increased risk of SUID, this association disappeared once intrauterine growth restriction was adjusted for [26]. Hung et al also investigated the determinants of unexplained antepartum fetal deaths and once they excluded extremely growth restricted infants, found there was no significant relationship between maternal smoking and unexplained fetal death [27]. Both studies potentially suggest that fetal growth restriction may potentially be a pathway via which smoking impacts on risk of fetal death in this context.

The above evidence therefore suggests that smoking is associated with, if not a cause of, stillbirth, with the risk being mediated primarily through growth restriction and placental pathology. There is evidence however, that smoking mothers appear to be at greatest risk earlier in pregnancy, with the risk of stillbirth associated with cigarette smoking disappearing when term antepartum deaths are analyzed specifically [11]. Importantly it has been shown that if women can give up smoking during the first trimester, the risk of stillbirth is equal to that of non smokers [11, 28]

Obesity

As the prevalence of obesity has increased around the world, the prevalence of overweight and obese women of childbearing age has also increased [9, 21]. Obesity (along with low socioeconomic status and advanced maternal age), is one of the most common risk factors for stillbirth [9, 10]. Initially it was speculated that this association reflected the fact that other risk factors for fetal death (e.g. gestational diabetes, cigarette smoking and pre eclampsia) were higher in obese women. However, it is becoming apparent that even when these factors are adjusted for, obesity remains an independent risk factor for fetal death [9].

Three studies from Sweden have investigated the risk of stillbirths associated with increasing maternal body mass index (BMI). The first, by Cnattingius, explored the associations between pre-pregnancy BMI and late fetal death [29]. The study included 167,750 Swedish women during 1992-1993 and found that obese women were more likely to have completed fewer years of formal education, be daily smokers and have diabetes compared to lean women. Adjusting for these and other demographic factors, the authors found that compared to lean nulliparous women, the risk of late fetal death was increased two fold in nulliparous women with a normal BMI, three fold in overweight women and four fold in obese women. For parous women, only obese women had a significantly increased risk of late fetal death compared to lean women [29].

The second Swedish study, undertaken by Stephannson et al, was a population based case control study that included all singleton births to nulliparous women in central Sweden, 1987-1996 [30]. In this study, univariate analysis found that being overweight or obese doubled the risk of antepartum death compared to the lean group (OR 2.1 (95% CI 1.4-3.1) and OR 2.4 (95% CI1.4-4.2) respectively). In contrast to Cnattingius et al, no significant difference in risk of antepartum death was found between women with a normal body mass index compared to the lean group. This study also found that overweight and obese women were more likely to be blue collar workers, to smoke and to have gestational diabetes, essential hypertension, pre eclampsia and eclampsia compared to normal or lean women [31]. When these factors were adjusted for the risk of antepartum death remained nearly double for overweight (OR 1.9 95% CI 1.2-2.9) and obese (OR 2.1 95% CI 1.3-3.6) women compared to lean women. When term antepartum death was looked at specifically; overweight and obese women faced an even higher risk of fetal death, with the OR approaching 3 for both groups [31].

Following this study Cedergren undertook a prospective population based cohort study, again in Sweden, to evaluate whether morbidly obese women were at increase risk of preeclampsia, placental abruption, placenta previa and stillbirth after 28 weeks among singleton pregnancies [32]. Women with a BMI of >35.1 were considered to be morbidly obese and were compared to normal weight women (BMI 19.8-26). The majority of the women were of European Caucasian descent (>96%). Maternal age, parity, smoking, education level and year of birth

were recognized as potential confounders and were adjusted for in the analysis. Being morbidly obese increased the risk of stillbirth nearly three-fold (adjusted OR 2.79 (95%CI 1.94-4.02), with the author suggesting that the association between obesity and stillbirth appeared to be influenced by the degree of obesity [32].

This dose-response relationship between obesity and risk of fetal death was also explored in a recent US study that included 1,413,953 mother-fetus pairs from Missouri during 1978-1997 [21]. The study divided women four groups based on their BMI; Normal (BMI 18.5kg/m^2-24.95kg/m^2), class I obesity (BMI 305kg/m^2-34.95kg/m^2) class II obesity (BMI 355kg/m^2-39.95kg/m^2) and extreme obesity (BMI ≥405kg/m^2). Stillbirth was defined as any in utero death at 20+ weeks (which differs from the Swedish studies which considered only late fetal deaths). The authors found that obese mothers were more likely to be older, multiparous and black [21]. There were also higher frequencies of diabetes, chronic hypertension, pre eclampsia and eclampsia in obese women compared to non obese women. In contrast to the Swedish studies [29, 31, 32], obese women were more likely to have a higher level of high school education compared to non obese women and were less likely to smoke. Obese women were also more likely to have adequate levels of prenatal care compared to non obese women. Overall obese women had a 50% higher risk of stillbirth compared to normal weight women with extremely obese women having twice the risk of fetal death compared to women with a BMI within the normal range. This finding is consistent with the Swedish studies [29, 31, 32] although the magnitude of risk from obesity is not as large. This risk difference may be due in part to the different definition of stillbirth that was used in the different studies, as obesity related fetal death has been shown to increase with increasing gestational age [33]. The authors also explored the black-white disparity amongst obese pregnant women and found that, while the risk of stillbirth increased in both groups with increasing BMI, there was a persistent absolute risk difference for obesity related stillbirth of approximately 50% greater in blacks [21]. The authors suggest that this disparity may be due in part by the difference in incidence of co-morbidities between the two groups with blacks having higher rates of undiagnosed hypertension, for example, which in turn leads to placental dysfunction [34].

A meta-analysis was recently undertaken to summarize the evidence on the relationship between maternal overweight and obesity and the risk of fetal death. The meta-analysis included 6 cohort studies and 3 case controlled studies which came from a variety of countries including the United States, Sweden, Norway, Benin, Denmark, The United Arab Emirates and the UK. The authors found that the odds of a stillbirth were increased in women who were classified as both overweight (unadjusted OR 1.47 (95% CI 1.08-1.94) and obese (unadjusted OR 2.07 (95%CI 1.59-2.74)[35].

Aside from clustering of risk factors, a number of other explanations have been proposed in an attempt to explain the relationship between maternal obesity and fetal death. It has been suggested that thinner women may have a better sense of fetal movements compared to overweight or obese women, which would facilitate more timely recognition of fetal distress and appropriate intervention [9, 29]. It has also been noted that maternal obesity is associated with hyperlipidemia [9] which has the potential to cause endothelial dysfunction, platelet aggregation and clinically significant atherosclerosis by altering prostacyclin secretion and peroxidase production [9, 29, 35].

Sleep abnormalities have also been suggested as an explanation for increased stillbirth rates in obese women. A retrospective, cross sectional, consecutive case series (which included 502 women with singleton pregnancies) was undertaken in Sweden to explore the relationship between snoring and pregnancy-induced hypertension and fetal growth retardation [36]. The study found that habitual snoring during pregnancy was associated with hypertension, preeclampsia, oedema and increased body weight. Women who were habitual snorers were also more likely to have a growth retarded fetus and a low Apgar score for the infant. Although the conclusions that can be drawn are limited by the study design, the authors suggest that increased upper airway resistance during sleep may affect the fetus and contribute to intrauterine growth retardation and may also contribute to the development of pregnancy induced hypertension and preeclampsia [36]. Sleep related disordered breathing has also been studied in obese women during pregnancy [37]. A case control study was carried out to

compare breathing during sleep in otherwise healthy obese pregnant women (BMI>30) compared to pregnant women of normal weight (BMI 20-25). The study found that there was significantly more sleep related disorders in obese pregnant women compared to pregnant women of normal weight and it is suggested that this disordered sleep may contribute to adverse pregnancy outcomes [37, 38].

Diabetes

It is well recognized that poor glycaemic control in women with pre gestational diabetes is associated with an increased incidence of congenital abnormalities and stillbirth [15, 38]. Preconception care for women with diabetes that results in attainment of optimal glucose control is associated with reduced incidence of congenital abnormalities and a decrease in spontaneous abortions [38]. Despite this, many women with diabetes do not plan their pregnancies or have preconception care [38]. There are also likely to be an increasing number of women with undiagnosed Type II diabetes who are unaware that they need to seek such care [15, 18, 39].

The rate of congenital abnormalities in diabetic women has remained significantly higher than the general population, despite decreases in the risk of other maternal and perinatal complications associated with diabetes [38]. Congenital abnormalities are the leading cause of perinatal deaths in infants of diabetic mothers [38]. A number of congenital abnormalities are more common in infants born to diabetic mothers with Type 1 or Type II diabetes. These include cardiovascular anomalies (most commonly), central nervous system and skeletal malformations. Infants of diabetic mothers are also more likely to have abnormalities of their renal and gastrointestinal systems [38]. Although the basis for the teratogenic effects resulting from diabetes is incompletely understood, it is clear that there is a strong correlation between malformations and poor glycaemic control in early pregnancy [38]. There is some evidence that the disruption causing these malformations occurs during organogenesis and is associated with abnormal metabolism secondary to hyperglycaemia [38]. It is thought that overproduction of oxygen free radicals results from maternal hyperglycaemia and these in turn directly damage tissue proteins [38].

The increased risk of fetal deaths in diabetic women may also reflect an increased risk of placenta abruption and pre eclampsia, as well as an increase in the risk of congenital abnormalities [13]. Fetal growth abnormalities (growth restriction and excessive growth) are also more common in women with diabetes both of which can increase the risk of stillbirth [38]. It is thought that the increase risk of stillbirth in large infants is due to maternal hyperglycaemia causing excess fetal hyperglycaemia, which in turns leads to increased (excess) insulin production by the fetus to keep glucose level within a normal physiological range. Insulin then stimulates fetal growth. Excessive fetal growth can result in metabolic acidosis, if placental oxygen is insufficient and it is postulated this process may end in fetal death [15].

In terms of the magnitude of the risk and its impact over time, a large American study involving 10,614,679 women found diabetic women to have an adjusted relative risk for fetal death of 2.5 (95% CI 2.3-2.7), compared to low risk pregnancies [40]. Frett et al also reviewed the changing pattern of fetal death from 1961-1988 and noted that the fetal death rates in diabetic women requiring insulin had reduced substantially over this period, but remained significantly elevated compared to the population without risk factors (RR 3.27 95% CI 1.04-10.3)[13]. The risk of fetal death for diabetic women treated by diet alone also declined, and while fetal death rates remained higher than that the low risk population, this did not reach statistical significance (RR 2.10 95% CI 0.96-4.59)[13].

In addition, the number of women with Type II diabetes mellitus is increasing and subsequently the number of pregnancies in women with Type II diabetes now exceeds the number of pregnant type I diabetic women in many parts of the world [39]. The relevance of this for Pacific women was recently highlighted by an Auckland based observational study exploring perinatal mortality in Type II diabetics during 1985-1997 [39]. In this study, the authors classified women as a Type II diabetic if they were diagnosed with gestational diabetes during pregnancy and were subsequently confirmed, by a repeat glucose tolerance test, to have Type II diabetes mellitus early in the post partum period. The study included

82025 infants born to women without diabetes, 160 births to women with Type 1 diabetes, 932 births to women with gestational diabetes mellitus (GDM) and 434 births to women with Type II diabetes. Of note 178 (41%) of the women included in the Type II diabetic group who were initially diagnosed as GDM were subsequently confirmed as Type II diabetics post partum. The authors suggest that most of these women probably had undiagnosed diabetes prior to pregnancy. In this study perinatal mortality was divided into intermediate fetal death (20-28 weeks), late fetal death (>28 weeks) and early neonatal death (<1 month of age).

In this study, the perinatal mortality rate was 46.1/1,000 in women with Type II diabetes. This was significantly higher ($p<0.0001$) than women with Type 1 diabetes (12.5/1,000), those with gestational diabetes (8.9/1,000) and women without diabetes (12.5/1,000)[39]. Congenital malformations accounted for only 10% of perinatal mortality in the diabetic group [38]. Women with Type II diabetes were significantly older, had higher parity, were more obese and presented later in pregnancy compared to women with Type I diabetes. Women with Type II diabetes also had a 7 fold increase in the rate of late fetal death compared to women without diabetes ($p<0.0001$). Pacific women made up the majority of women with Type II diabetes identified in the study with 56% of known diabetes and 71% of newly presenting diabetics being of Pacific ethnic origin. In contrast, Pacific women only made up 3% of the Type I diabetic population. In the non diabetic population, Pacific women had a perinatal mortality rate of 11.6/1,000 which was lower than for Māori (15.8/1,000) and European (12.8/1,000) women. Looking more closely at the constituent causes, it was noted that Pacific women had lower intermediate fetal death rates than Māori or European women, similar neonatal mortality rates, but higher late fetal death rates [39]. While it is important to consider confounding factors such as obesity, low socioeconomic status, greater maternal age and hypertension that may cluster with Type II diabetes, this study [39], and the work looking at unexplained fetal death [41], suggest that undiagnosed Type II diabetes may be an important risk factor for late fetal death in Pacific women.

Socioeconomic Status

It is well recognized that socioeconomic status influences stillbirth risk, with women of lower socioeconomic status having a higher risk of stillbirth compared to women in more affluent areas [10, 11, 27, 42]. This has been shown to be true in New-Zealand, with women living in more deprived areas having higher rates of late fetal death than those living in the least deprived areas [2]. There has been much speculation however, as to whether these differences can be explained by the higher prevalence of other key risk factors amongst women living in more deprived areas (e.g. smoking is more common in women of lower socioeconomic status) and thus whether the increase risk of stillbirth reflects the unequal distribution of these risk factors, or whether there is some other mechanism by which socioeconomic status increases stillbirth risk.

In order to explore this issue further, Stephansson et al undertook a population based case-control study in Sweden to investigate the association between socioeconomic status and different subgroups of stillbirth ≥28 gestation [43]. The study included 702 cases and 702 controls and found that there was an increased risk of stillbirth in women of lower socioeconomic status, as defined by occupational status. The risk of stillbirth for unskilled blue collar workers was twice that of high level white collar workers (crude OR 1.9 95% CI 1.2-2.9). Women of lower socio economic status however were found in general to be younger, and when maternal age was adjusted for in the analysis, unskilled blue collar women were at even higher risk of stillbirth compared to high level white collar workers (OR 2.6 95% 1.7-4.2). The authors also adjusted for BMI, height, country of birth, smoking status and found that the risk of stillbirth remained higher than the univariate analysis for women of lower socio economic status. When the timing of stillbirth was explored, it was noted that there were no significant differences in risk of preterm antepartum stillbirth between women with the lowest and highest socioeconomic status (OR 1.3 95% 0.9-1.9). At term however, women of lower socioeconomic status were at higher risk of antepartum (and intrapartum) stillbirth (OR 1.9 95% CI 1.3-3.0).

Similarly Goy et al undertook a population-based case control study in Canada (112 cases and 398 controls), to explore the proportion of stillbirths in women of low socioeconomic status which can be explained by other health-risk factors [42]. Educational, household income

category and occupation were collected to provide an estimate of individual level socioeconomic status. Census derived Dissemination Areas were also determined, by post code, to provide an indication of community level socioeconomic position. The authors found that of the individual level measures of socioeconomic status, only household income was a significant predictor of stillbirth. Because of this, household income was used in the further analysis as the measure of individual level socioeconomic status. Other explanatory variables included: marital status, exposure to second hand smoke, use of folic acid pre conception, activity level during pregnancy, parity, pregnancy interval, use of fertility treatments, history of miscarriage and employment in shift work. The study found that women in the lowest income group (< $20,000) had a three-fold increase in stillbirth risk compared to those in the highest income bracket (>$60,000) (OR 3.02 95% CI 1.47-6.20). When potential confounders were adjusted for, a strong socioeconomic gradient remained (OR 2.79 95% CI 1.21-6.43). In addition, it was estimated that smoking accounted for 18.5% of the increase in the OR for the lowest income category [42]. (Note: Goy et al did not include medical conditions (such as hypertension or diabetes) as possible risk factors for stillbirth. In addition, in contrast to Goy et al's findings, other studies have found that maternal education and neighbourhood income were both associated with elevated crude risks of stillbirth [10, 12, 44]).

Similarly in New Zealand, Craig et al [3] explored the risk of late fetal death and found that fetal deaths from congenital anomalies, or occurring in labour did not demonstrate a social gradient. However women living in more deprived areas had a higher risk of late fetal deaths from antepartum asphyxia, or due to unspecified causes, compared to women living in less deprived areas [3]. Overall, when all causes of fetal death were considered as a group, a social gradient was evident with women living in the most deprived areas (decile 9 and 10) having a 50% higher risk of stillbirth compared to those living in the most affluent areas (OR 1.48 95% CI 1.29-1.71)[3].

Thus the above studies suggest that socioeconomic status (as measured by occupation or household income) is a strong risk factor for stillbirth, with social gradients in some studies persisting when health-risk factors more prevalent in women of lower socioeconomic status are adjusted for. The exact pathways via which these social gradients occur however, remains unclear.

Ethnicity

Many of the studies exploring risk factors for stillbirth have been undertaken in homogenous populations with Caucasian / European predominance [4, 29, 30, 42, 43]. When studies have been undertaken in more ethnically diverse populations however, ethnicity has been found to be an important determinant of stillbirth risk [25, 45].

In New Zealand it has been recognized for several decades that Pacific women have higher stillbirth rates that other ethnic groups [46]. Gunn et al compared Pacific Island stillbirths with European stillbirths at St Helen's hospital in Auckland during 1967-1978. Of the 71 Pacific stillbirths recorded in this period, there were records for 65 (92%) available for review. The authors noted 5 Pacific Island infants with antemortem intracranial haemorrhages, as compared to only one such haemorrhage in a European infant. This finding sparked interest in why the number of intracranial haemorrhages was so high in Pacific infants. Two further studies confirmed higher rates of intracranial haemorrhages in Pacific infants; a large retrospective study (where 3500 perinatal deaths (all with post-mortems) from 1966-1982 were reviewed) identified 20 stillborn Pacific infants with unexplained intracranial haemorrhages [47] and another study identified 47 cases of major intracranial haemorrhages in infants born to Pacific parents during the time period 1968-1986 [48]. Following the findings of these studies it was hypothesized that these intracranial haemorrhages may result from traditional abdominal massage [48, 49]. It was noted that from 1986 the rates of intracranial haemorrhage decreased abruptly and it is speculated that this resulted from publicity around the dangers of traditional massage on the fetus[48].

More recently, analysis of New Zealand birth registration data for 1996-2001 [2, 50-52] found that Pacific and Indian women were significantly more likely to have a late fetal death than European women (OR 1.26 95% CI 1.01-1.6 and OR 1.73 95% CI 1.13-2.66 respectively)[2]. Māori women however, did not have a significantly increased risk during this period. The

authors hypothesised that the increased risk of late fetal death in Pacific women might be attributable to the higher rates of obesity among Pacific women [50].

Similarly, McCowan et al recently compared data from a cohort of 437 stillborn babies, born during 1993-2000 at National Women's hospital in Auckland with that of 69,173 live births occurring during the same period [25]. In this study, Pacific and Indian women were again significantly more likely to experience a stillbirth compared to European women (even when adjusted for infant sex, parity, maternal smoking, marital status, maternal age at delivery, history of previous miscarriage, history of previous induced abortion, history of previous low birth weight infant, history of previous Caesarean section and multiple pregnancy).

In Australia, Mohsin et al investigated antenatal and maternal factors risk factors for stillbirth in New South Wales, Australia [12]. Approximately 2.4% (n=10,589) of the women included in the study were of Aboriginal background. Aboriginal women were found to have a higher rate of stillbirth (10.6/1000) compared to non Aboriginal women (6.3/1000) but this did not reach statistical significance (OR 1.12 95% CI 0.89-1.42). The authors cite evidence that other risk factors such as cigarette smoking, alcohol, poor antenatal care, younger age and being single are more common in Aboriginal women compared to non-Aboriginal women and suggest this may be explain the higher rates of stillbirth in indigenous women[12].

Similarly, in America, black women have approximately twice the risk of stillbirth compared to white women, if differences in obstetric and socioeconomic factors are not adjusted for [9]. Using United States national mortality data from 1995-1997, Vintzileous et al explored the impact of prenatal care on fetal deaths (in the presence and absence of obstetric and medical risk factors), in order to better understand the reasons for white black disparity [45]. In total, 10,560,077 singleton births >24 weeks gestation were included in the study, with 29,469 fetal deaths occurring during this period. In 120,421 cases (1.1%) women did not receive prenatal care. The study found that lack of prenatal care was associated with an increased risk of fetal death for women with and without high risk medical conditions [45]. Black women were 3.3 times more likely not to have received antenatal care compared to white women [45]. The excess fetal death rates between blacks and whites who sought prenatal care was lower (1.8/1000) than those without care (4.7/1000), potentially suggesting that prenatal care can help to decrease disparities in pregnancies between black and white women in America. However while provision of prenatal care decreased disparities between these two ethnic groups; large disparities remained with black women having higher rates of stillbirth even when prenatal care was provided. The authors attributed the difference in stillbirth rates to higher rates of diabetes, hypertension, placental abruption and premature rupture of membranes in black women[45].

In another US study, Herchel et al investigated the cause of fetal deaths among black women in Chicago and compared these to fetal deaths in the predominantly white population in Canada [53]. They found that black women had a much higher rate of hypertensive – associated fetal mortality (x9), placental abruption (x2), cord prolapse, intrapartum asphyxia and beings small for gestational age [53]

Thus while ethnicity remains a key risk factor for stillbirths, the precise pathways via which this occurs remain unclear. The available evidence however would suggest that ethnic differences in the prevalence of known risk factors (e.g. obesity, smoking, lower socioeconomic status, hypertension and diabetes) may contribute to some of the differences seen.

Advanced Maternal Age

Advanced maternal age has long been recognized as a risk factor for fetal death. In recent years there have been a number of social and economic changes that have resulted in women delaying childbearing until their mid to late thirties. Technological advances in reproductive health have also helped to facilitate this demographic shift [54].

In this context, a recent systematic review was undertaken to review the influence of older maternal age on the risk of stillbirth [55]. The review identified 37 studies which met the inclusion criteria (31 cohort studies and 6 case control studies), with the majority being from North America and Europe (n=25) (a small number were from Asia, Latin America and Africa). Overall 24 of the 31 retrospective cohort studies found a statistically significant association

between increased maternal age (most commonly defined as >35 years) and stillbirth, with crude relative risks ranging from 1.2-4.53 for older vs. younger women. All 6 case control studies also found a significant association, which was of similar in magnitude to that reported in the cohort studies [54]. In all the case control studies and in 15 of the retrospective studies potential confounders were controlled for. Confounders varied by study, but most frequently included parity, smoking, education, BMI, ethnicity, chronic medical conditions and prenatal care. In all but one study, the adjustment for confounders did not alter the risk of stillbirth conferred by advanced maternal age extensively [55]. The absolute risk of stillbirth was found to be lower in developed countries, where the baseline stillbirth rate was 1.55-17.89/1000 births, with older women having a crude odds ratio of stillbirth varying from 1.20-2.23. Of the 14 studies that adjusted for potential confounders, 8 found less than a 10% difference between crude and adjusted rates, suggesting that advance maternal age may well be an independent risk factor for stillbirth [54].

Two New Zealand studies have looked at maternal age as a risk factor of stillbirth. Craig et al looked specifically at late fetal death and found an increased risk of stillbirth associated with advanced maternal age (adjusted OR women >35 years 1.63 95% CI 1.22-1.99)[3] while McCowan et al included all stillbirths >20 weeks gestation and did not find an association between stillbirth and advanced maternal age (adjusted OR for women > 35years 1.30 95% CI interval 0.98-1.37)[25].

Historically the increased risk of fetal death in older women reflected, in part, the increased risk of congenital abnormalities in this group. The increased availability of antenatal screening and elective terminations has lead to a significant reduction in this cause of fetal demise [9, 20]. It has also been suggested that older women have poor uterine vasculature resulting in poor placental perfusion [9]. Older women are also more likely to utilize reproductive technologies which are associated with excess perinatal mortality due to multiple gestations, low birth weight and small for gestation fetuses in singleton pregnancies[9].

Multiple Births

The rate of multiple births has been increasing rapidly in developed countries during the last 20 years, due mainly to the increased availability of assisted reproductive technologies [9]. Multiple pregnancies make up about 3% of all births but account for 10% of stillbirths [15] with all types of death more common for multiples than singletons [7]. The increased rate of fetal death in multiples is due to a number of complications specific to multiple pregnancy (twin to twin transfusion), as well as increase risk of fetal anomalies and growth restriction. Intrauterine death is less common in the presenting fetus than the trailing fetus and while it has not been proven, it is thought that this increase risk in the trailing twin reflects an underlying condition that ensured the presenting twin was presenting rather than as a result of position or mechanical forces [7]. Having said this, causes of fetal death in multiple pregnancies are not well understood. It is recognized that monochromic multiple pregnancies are associated with a higher rates of fetal death, which is thought to be due to the arrangement of the vascular anastamoses in the multifetal placenta[15].

Drug use

It is difficult to prove conclusively that an external exposure such as drug use causes stillbirth [15]. Substances that have been implicated in stillbirth include cocaine, marijuana, methamphetamine and alcohol. There is conflicting evidence about whether alcohol consumption is associated with an increase risk of stillbirth and the relationship between Methamphetamine and stillbirth is not clear [15]. It appears that Marijuana is not associated with an increased risk of stillbirth [56] and the risk conferred from cocaine use has been difficult to tease out from confounding factors such as other substance use, socioeconomic status and prenatal care [57].

Fetal Growth Impairment

Fetal growth restriction (FGR), intrauterine growth restriction (IUGR) and small for gestational age (SGA) are all terms that are used to describe the growth of a fetus. The terms FGR and IUGR are used to describe fetuses that are smaller than expected, given their genetic potential, or where there is evidence of slowing or absent fetal growth [58]. Traditionally a fetus is defined as SGA when it is below 5th or 10th percentile for its gestational age when

compared to a population birth weight standard. However when a population standard is used, by definition 10% of babies will have a weight <10th percentile and this does not necessary confer increase risk, if there are genetic or constitutional factors that account for this "smallness" [59]. As Altman points out "A single estimate of fetal size in late pregnancy is of little or no help to the obstetrician" as it fails to distinguish between those fetuses that are constitutionally small but growing normally and those fetuses where growth has decelerated due to an underlying pathological process [59]. Distinguishing between these two groups is important because the fetus that is small because of fetal growth restriction should be considered at greater risk than one that is constitutionally small [5, 60].

In New Zealand, there are ethnic differences in fetal growth, with Pacific babies being significantly heavier than European babies [61]. In this context, the use of customised percentiles improves the distinction between normal and abnormal growth [60], as maternal variables such as parity, ethnicity, booking weight and height all have a independent effect on expected birth weight [61]. Customised fetal and birth weight percentiles take these factors into account when determining appropriate size and growth of fetuses and are thus of value in providing estimates of expected fetal growth for different ethnic groups. Prior to the development of customized charts for the New Zealand population, SGA in Pacific fetuses and babies was probably under recognized because the standard used was based on European populations. Such customized growth charts are now available for different ethnicities living in New Zealand [60, 61]. (Note: The other important factor in determining an accurate estimate of fetal growth / relative size is accurate dating of pregnancy. An early crown rump length is useful in dating a pregnancy, however this may not be available for all pregnancies [62]. Later ultrasound scans are less reliable at dating fetuses if using standard head and abdominal circumferences. Using transcerebellar diameter has been shown to be more accurate at determining gestational age in the second half of pregnancy [62]).

In terms of stillbirth risk, a number of studies have established that fetal growth restriction is a risk factor for antepartum fetal death [5, 13, 41]. In a study of 149 third trimester fetal deaths that occurred before the onset of labour (where congenital abnormalities and multiple pregnancies were excluded), Gardosi et al [5] found that that 40% of non malformed stillbirths were SGA. This was most marked in the preterm period; at 31-33 weeks, 63% of all stillbirths and 73% of "unexplained fetal deaths" were SGA, thus suggesting a strong association between fetal death and slow growth rate [5].

Cnattingius et al examined the associations between SGA, known SGA risk factors and late fetal deaths [63] using birth weight ratios (the ratio of observed to expected birth weight for a fetuses' gestational age and sex) to define SGA. A normal birth weight was defined as ≥0.90, mild SGA as <0.90 but >0.75, and extremely SGA as ≤ 0.75. The authors found that fetal deaths were much higher in extremely SGA fetuses compared with non-SGA fetuses [63]. If a fetus was extremely SGA the risk of late fetal death was increased if the mother was 35+ years, was taller (≥175 cm), was non-hypertensive, nulliparous, or a non-smoker, or if the baby was a singleton. In those fetuses that were mildly small for gestational age, late fetal deaths were increased in women who were ≥35 years, ≥155cm in height or had twin pregnancies or severe preeclampsia. Despite the risk of fetal death in SGA infants varying by cause, the authors emphasized the importance of close monitoring of all SGA fetuses, because of the much higher risk of late fetal death in extremely SGA fetuses regardless of the cause [64].

While fetal growth is influenced by genetic variation and congenital abnormalities, the intrauterine environment also plays a significant role [58]. As described above, there are a number of factors that have been identified that influence this environment (including maternal weight, smoking status, socioeconomic factors and hypertension) and which are associated with SGA. Growth restriction that occurs in fetuses without other environmental causes is thought to reflect poor placental function due to ischemic placental disease. The term ischemic placental disease is used to describe a disease process that can manifest clinically as preeclampsia, abruption or a combination of these. The exact mechanism responsible for placental dysfunction is not clear but it is assumed that normal angiogenesis and placental development is altered in pregnancies with fetal growth restriction [7, 62].

Fetal growth restriction and small for gestational age are thus now well recognized risk factors for fetal death. The magnitude of the risk of fetal death depends on whether the fetus is small for constitutional or other reasons. As discussed initially (and further below) the distinction between a risk factor and cause of fetal death is debatable. Some classification systems such as the Perinatal Society of Australia and New Zealand Perinatal Death Classification system include growth restriction as a cause of death. While this does help differentiate fetal deaths that occur in growth restricted fetuses from other unexplained fetal deaths, fully understanding the risk of stillbirth and developing ways to manage these pregnancies is limited because the underlying mechanism causing poor growth and death is often not well understood. Management of growth restricted infants includes close monitoring and early delivery when the risks of continuing in utero outweigh the potential risks associated with premature birth.

Unexplained Stillbirths

Unexplained Stillbirths

Despite advances in medical technology a large proportion of fetal deaths remain unexplained
There is a difference between unexplained and unexplored fetal deaths
The proportion of fetal deaths that remain unexplained, after investigation, depends on which classification system is used
Risk factors for unexplained death include advanced maternal age, low socioeconomic status, and advanced gestation.

The previous two sections have reviewed known causes and risk factors for fetal death. Despite advances in medical technology however, a large proportion of fetal deaths remain unexplained [9]. This probably reflects both a lack of systematic investigation and classification of fetal deaths, as well as limitations of medical science to identify the underlying pathophysiology in fetal deaths[9].

There are a number of classification systems used to allocate fetal deaths to a presumed cause and there has been considerable debate about whether risk factors such as hypertension and growth restriction can be included as causes of fetal death in these classifications. It can be appreciated that the proportion of unexplained fetal deaths will be influenced by the classification system used, and whether it allows such “risk factors” to be presumed causal in these contexts. Some classifications, such as the modified Wigglesworth system, do not include intrauterine growth restriction as a cause of death. Although the Wiggleworth system does differentiate unexplained fetal death on the basis of fetal weight, it is of limited value because does not adjust for gestational age [7].

One recent study compared four different classification systems in order to identify which system minimized the rate of unexplained stillbirth after a full evaluation, including autopsy [65]. The study found that the Wigglesworth classification failed to identify a cause of stillbirth in nearly 50% of cases. This was higher than for newer classification systems, with unexplained stillbirths accounting for 18.2% of fetal deaths using the Galan Roosen Classification, 14.3% using the ReCoDe Classification and 16.2% using the Tulip Classification system [65]. In a similar study, Gardosi et al found that the highest proportion of stillbirths remained unexplained (despite all cases undergoing a post mortem) when classification systems were used which did not recognize fetal growth restriction as a cause of fetal death [5].

A number of studies have also explored the epidemiological characteristics of unexplained intrauterine death [4, 27]. Yudkin et al reviewed the risk of unexplained stillbirth at different gestational ages [66] in 40888 deliveries in England during 1978-1985. During this period there were 146 late fetal deaths, of which 43% (n=63) were unexplained. Post-mortems were carried out in 91% and cause of death was assigned by one of two obstetricians. (Note IUGR or SGA were not recognized as a cause of death in the classification system used). The authors noted that risk of unexplained stillbirth increased with increasing gestational age, with risk at 41 weeks being four times that at 33 weeks [66].

Huang et al investigated unexplained antepartum fetal deaths in a large cohort based study in Canada [27]. Unexplained fetal death was defined as “deaths occurring before labour with no

evident fetal, maternal or placental abnormality sufficient to be considered the cause of death". There was a 97% autopsy rate and all cases were included in the study, even if a post mortem was not performed. Of the 721 fetal deaths, 26% (n=196) were determined to be unexplained antepartum fetal deaths. The majority (75%) occurred after 35 weeks gestation. A number of independent risk factors were identified which included advanced maternal age, pre pregnancy weight >68 kg, low socioeconomic status, birth weight to mean weight for gestational age between 0.75-.85, primiparity, presence of cord loops, fewer than four antenatal visits in women who fetuses dies at ≥ 37 weeks and parity of three or more [27].

Similarly, a case control study in Sweden to investigate risk factors for sudden unexplained fetal death (SIUD) only included fetal deaths (>22 completed weeks and ≥500g) if they had undergone a full post mortem. SUID accounted for 26% of fetal deaths[4], with risk factors including maternal age ≥ 35 years, low maternal education, high cigarette use, and obesity. The authors also found that SIUD occurred significantly later in pregnancy compared to stillbirths of other causes. In contrast to Huang et al [27], primiparity was not found to be associated with SIUD. One fifth of the group with SIUD had glycosuria but none had been diagnosed with diabetes. The authors suggest that some of the unexplained deaths may have been related to unrecognized diabetes mellitus[4].

Froen et al also looked specifically at risk factors associated with unexplained antepartum stillbirth [41]. All of the stillbirths included in the study had to meet the following definition:' *Intrauterine death before the onset of labour in a fetus of >22 weeks completed gestation or >/= 500g body mass, which was unexpected by history and in which a through autopsy of the fetus together with gross and histologic examination of the umbilical cord, placenta and membranes fails to demonstrate an adequate cause of death* [41]. The study explored a number of risk factors for SIUD including; intrauterine growth restriction (IUGR), maternal age, smoking status of the mother, maternal BMI and maternal education level. This study defined IUGR as birth weight <10th percentile using a customized standard and adjusted for maternal height, weight, ethnic group, parity and sex of the baby. Of the unexplained stillbirths included in the study 52% (n=38) were found to have IUGR and this suboptimal growth was found to be the most important fetal determinant for SIUD with an odds ratio of 7.0 (95% CI 3.3-15.1). Maternal BMI >25kg/m^2, low educational attainment and smoking significantly increased the risk of SIUD in growth restricted fetuses. While maternal smoking was found to significantly increase the risk of SIUD on univariate analysis, once growth restriction was added to the model maternal smoking became non significant.

In addition, a frequent and understandable concern expressed by most women following a stillbirth is the likelihood of another stillbirth. The answer to this question obviously varies depending on the cause of fetal death. In general, if women who have experienced a stillbirth are treated as a group, then their risk of future stillbirth is estimated to be around 2-10 times higher the background rate [67, 68]. An Australian case control study investigated the risk of stillbirth in women who had previously experienced an unexplained stillbirth [68]. The study included 224 women from South Australia who had experienced an unexplained stillbirth in the period 1987-1997. Indigenous women were excluded because of small numbers (n=14) and concerns that including this group would skew the total results because of previously documented higher rates of perinatal mortality in this group. The classification system used in the study did include fetal growth restriction as a cause of death.

The authors found that while women who had experienced a previous unexplained stillbirth were at increase risk of obstetric complications (such as antepartum haemorrhage, preterm labour) and intervention at the time of delivery (C-section, forceps), there was no increase risk of stillbirth compared to the low risk controls[68]. The authors did comment on the statistically significant increases in the rate of preterm birth and births of reduced gestation (which were independent of induced labour or C–section) in women who had previously had an unexplained stillbirth and hypothesized that these may reflect an underlying process associated with growth restriction and preterm birth[68].

It can be seen from the above studies that there are a number of consistent risk factors for unexplained fetal death. Because the association between growth restriction and fetal death is so well established, growth restriction is now separated out from unexplained death in many of

the newer or revised classification systems. This is likely to alter the proportion of fetal deaths that are considered to be unexplained, even though the mechanism that leads to poor fetal growth is often not well understood. Other risk factors for unexplained fetal death include advanced maternal age, low socioeconomic status, and advanced gestation. The evidence also suggests that undiagnosed diabetes may contribute to "unexplained" fetal deaths. The influence of smoking is less clear once fetal growth has been adjusted for. There is only limited literature that addressing the risk of recurrent stillbirths in this group but it appears that, with good obstetric care, the increased risk of recurrent stillbirth may not increased.

Role of the Post Mortems in Establishing the Cause of Fetal Deaths

Role of the Post Mortem: Key Points

A post mortem is a useful investigation to help establish the cause of a fetal death
Post mortem rates are low in New Zealand
Institutional resources and cultural beliefs probably influence post mortem rates

Being clear about the cause of stillbirth is valuable for a number of reasons. Importantly if factors can be identified that contribute to fetal death, counselling can be offered to families and potentially the management of future pregnancies can be altered [8]. Another benefit of accurately determining the cause of death, it that it improves the ability to monitor trends at the population level and to assess the effectiveness of public health programmes over time.

The value of undertaking a post mortem in cases of unexplained stillbirth has been established. Incerpi et al investigated the value of various tests in the evaluation of stillbirth and found that when an autopsy was performed in an otherwise unexplained fetal death, autopsy could determine the cause of death in 30% of cases [69]. Measey et al recently compared the proportion of deaths that remained unexplained after post mortem examination with estimates derived from death certificates [8]. In this study, the Perinatal Society of Australia and New Zealand Perinatal Death Classification system was used (which includes maternal risk factors and fetal growth restriction as a cause of death). In total, 328 deaths were identified as unexplained by death certificate, of which 212 could be explained following a post-mortem, while 116 remained unexplained. Thus 2/3 of deaths unexplained clinically could be explained after a post mortem was undertaken. A further study found that placental histology along with autopsy were the two tests which contributed most to the identification of causative or risk factors for stillbirths (out of a comprehensive protocol that included fetal ultrasound, karyotype, cultures, total body X-ray, maternal screening for thrombophilias, TORCH, Parvovirus, thyroid function, Coombs, Kleiheuer testing and genital cultures[65]).

Despite post mortems being recognized as contributing to the establishment of cause of death in stillbirths, the numbers of autopsies performed for stillbirth is variable. The Royal College of Obstetricians and Gynaecologists and the Royal College of Pathologists have previously recommended a 75% target for perinatal autopsies[8]. Although this recommendation has now been withdrawn, post mortem rates reported in a number of studies are well below this figure [3, 8, 69, 70]. A New Zealand study investigating late fetal death found that post mortem rates were declining and between 1995-1999 post mortem rates for singleton births was 42.2% [3].

It is important that post-mortems are undertaken following a stillbirth, as they increase the likelihood that the cause of death will be found. This is of value both to the families as well as to those trying to prevent stillbirths in the population as a whole. When classifying fetal death as unexplained it is important that only those that have undergone a full post-mortem examination are included in the unexplained group. If all fetal deaths are included under the umbrella of unexplained fetal death, whether or not they have been fully investigated, inaccurate information will be collected and will introduce bias into research undertaken to identify risk factors for unexplained fetal death [8].

The frequency with which autopsies are undertaken is likely to be determined by a number of factors. Some of these factors will relate to the capacity of institutions to perform such examinations, while other factors such as cultural beliefs of the family also come into play. An Australian study investigated characteristics of women who consented to a complete post mortem examination [8]. The authors found an association between maternal age and consent

for a post mortem examination, with younger women being more likely to consent to an autopsy. No significant difference was found between consent rates between indigenous and non indigenous women. It was also found that consent to post-mortem varied with gestational age at which death of the fetus occurred. Women who experienced a stillbirth between 30-36 weeks had the highest post mortem rate (57%) compared to 20-29 weeks (48%) and 40 plus weeks (47%)[8]. Silver et al suggest that improving the rates of autopsies can be improved by addressing families concerns about the process and possibly performed a modified autopsy if necessary to accommodate cultural and religious concerns[15].

There are a number of cultural values held by Māori in New Zealand which are challenged by the process of undertaking a post-mortem. Ideally immediately following death 'tuku i te wairua' is undertaken to ensure the spirit fully leaves the body [71]. Māori cultural protocols expect the body to be returned promptly to the immediate family, as it is custom to have a Tangi prior to burial of the body on the third day following death [71]. It is also important to Māori that the body of a dead person is treated with the upmost respect and all parts of the body are kept together and, ideally, buried as one [71]. The return, retention or destruction of bodily samples following post mortem have important cultural ramifications for Māori[71]. This is no literature that explores Pacific people's attitudes to post mortem examinations. More research is needed to explore the role of cultural factors and workforce issues in order to form a clearer picture of why post mortem rates in New Zealand are so low.

Causes and Risk Factors for Stillbirth: In Summary

As the above review suggests, stillbirths form a heterogeneous group, with a range of causes and risk factors being identified in recent years. In addition, in a large proportion of cases the underlying cause remains unknown, although the proportion of stillbirths which are unexplained varies significantly depending on the classification system used, as well as access to post-mortems and further investigations.

In New Zealand, Pacific women have higher late fetal death rates than other ethnic groups, and an understanding of the reasons for these differences is crucial if evidence based solutions are to be developed, to reduce this disproportionate risk future years. As identified in the earlier section on ethnicity, it is possible to speculate that some of the excess in risk of late fetal deaths experienced by Pacific women may arise from disproportionate exposure to known risk factors such as high maternal BMI, cigarette smoke, difficult socioeconomic conditions, Type II Diabetes and unrecognised fetal growth restriction (in the context where European growth standards are applied to Pacific babies). In addition, the New Zealand analysis of post-mortem rates by cause, and in particular the very low post mortem rates amongst Pacific babies where the cause of death was unspecified, potentially suggests that a large proportion of these deaths in may in reality be uninvestigated rather than truly unexplained.

Approaches to Prevention of Stillbirth

While a review of the causes and risk factors for stillbirth provides valuable insights into why Pacific women might experience higher rates of late fetal death, in itself such knowledge only provides a partial evidence base for developing solutions to reducing stillbirth rates amongst Pacific babies. In addition, what is also required is a more in depth review of the available literature, in order to determine whether evidence based approaches exist internationally for reducing the burden of fetal deaths at a population level.

In this context, Goldenberg notes that the reduction in stillbirths seen over previous decades have resulted from four main strategies [18].

1. **Identification of Risk Factors** with a view to their subsequent modification or elimination (e.g. use of anti-D).

2. **Identification of High Risk Pregnancies** (either because of fetal or maternal factors) and then monitoring those pregnancies using a second level test such as biophysical profile, with delivery being undertaken when the risk vs. benefit equation is felt to be in favour of delivery. There is much debate in the literature (well summarized by Smith and Frett [7]) about the value of antenatal monitoring, and attention is drawn to the

limitations of interpreting screening tests in low risk populations, as well as the need for subsequent protocols so that women identified by screening can be effectively managed in a way that decreases stillbirth risk.

3. **Intrapartum Monitoring**. While it is unclear exactly what influence intrapartum monitoring has had on fetal deaths, there has been a reduction in intrapartum stillbirths since monitoring was introduced, to the point where they are now relatively rare events in developed countries, [13].
4. The use of sophisticated and more readily available **Prenatal Testing** has lead to a decrease in late fetal and infant mortality through selective termination earlier in pregnancy.

The following sections consider the first two of the strategies described by Goldenberg, as they relate to Pacific women. Clearly being able to recognize the causes of, and risk factors for, fetal death in pregnant women is important if stillbirths are to be prevented. In addition, it is critical that once they occur, fetal deaths are classified according to standard classification system and regular reviews of local fetal deaths are undertaken [72]. The following sections briefly review some of the infrastructure, services and programs which might be required, if the higher rates of late fetal death amongst Pacific women are to be reduced in future years.

Approaches to the Prevention of Stillbirths

A number of approaches may be of value in reducing stillbirths in Pacific women. They include:

Prenatal and Antenatal Care	Ensuring early access to prenatal and antenatal care by reducing barriers (e.g. transport, childcare, culturally appropriate services)
Prevention of Congenital Anomalies	Ensuring women are aware of the benefits of prenatal folic acid supplementation prior to conception
Type II Diabetes Screening	Identifying women at high risk of type two diabetes, screening them prior to pregnancy and offering appropriate counselling
Obesity	Providing information on the association between stillbirth and obesity may strengthen the message that maintaining a healthy weight is important for the health and wellbeing of Pacific peoples.
Smoking	Smoking cessation programmes in pregnancy have the potential to reduce the proportion of women who continue to smoke
Fetal Growth Monitoring	The monitoring of fetal growth using customised growth charts may identify a larger proportion of growth restricted Pacific fetuses than if total population growth charts are used
Perinatal Death Reviews	Perinatal death reviews are of value in ensuring that key learning points can be gleaned from each death, so that deaths of a similar nature can be avoided in future.

Prenatal and Antenatal Care

When taking a risk factor identification approach, in addition to having a working knowledge of the common risk factors for stillbirth, it is also necessary to engage adequately with pregnant mothers, so that these risk factors can be identified and modified in an appropriate manner. It is widely accepted that antenatal (and in fact prenatal care) is important in improving pregnancy outcomes for both mother and infant [73]. A study by Vintzileos et al showed that perinatal care is a potentially modifiable risk factor for stillbirth in America, where increased access to antenatal care decreased the risk of stillbirth in black women [45]. While a review undertaken to look at the impact of prenatal care on birth outcomes concluded that prenatal care did not conclusively improve birth outcomes, the outcomes investigated were low birth weight babies and preterm delivery rather than fetal death [74].

In the New Zealand context, a study undertaken as part of the Pacific Islands families (PIF) study investigated antenatal attendance of Pacific mothers in South Auckland [73]. The study defined late initiation of antenatal care as initiating care >15 weeks gestation, and while there is some debate about the optimal number of antenatal visits required to improve pregnancy outcomes, the study classified inadequate attendance as being <6 visits (the number generally recommended in New Zealand) [73]. The study found that most mothers of Pacific

infants (99.1%) attended antenatal care at least once, but that many mothers initiated their antenatal care late (26.6%), or did not attend the recommended number of antenatal visits (10.7%). The study also found that in the cohort 60% of pregnancies were unplanned. A number of situational factors influenced whether or not women engaged in antenatal care. These included lack of transport, educational status, childcare accessibility, whether the pregnancy was planned and what social support is available to the mother [73]. Another New Zealand study also found that many Pacific mothers felt that antenatal classes were aimed at Pakeha mothers and had little relevance to them [75].

Primary Prevention of Congenital Anomalies

Congenital abnormalities are a common cause of fetal death and, as discussed in the preceding section, increased availability of prenatal screening and selective termination of abnormal fetuses has decreased the rates of late fetal death and infant mortality from congenital abnormalities[20]. However primary prevention would be preferable to selective termination. There is now good evidence that adequate peri-conceptual maternal folic acid supplementation is associated with reduction in the occurrence of neural tube defects, congenital heart defects, urinary tract abnormalities, pyloric stenosis, limb defects and orofacial clefts [76]. However because a large number of pregnancies are unplanned (estimated at 50% in United States [76] and 60% in PIF study [73]) the opportunity to ensure adequate folic acid supplementation may not always be present.

Recently (2007), the New Zealand Government passed a standard requiring all bread manufacturers to fortify bread with folic acid. While this is likely to increase the amount of folic acid consumed by women of childbearing age to 140 micrograms/day, this still remains less that the 400micrograms/day recommended to prevent congenital anomalies [76]. While it is acknowledged that many pregnancies are not planned, it is important that Pacific women of childbearing age are aware of the importance of pre-conceptual folic acid supplementation and primary care plays an active role in promoting this message.

Screening for Type II Diabetes

Similarly prenatal or early antenatal care is important for recognizing Type II diabetes prior to, or early in pregnancy. Diabetic associated malformations occur very early during pregnancy, with most occurring before the 8th week [38]. Historically attention has been focused on ensuring that women with Type I diabetes maintain tight glycaemic control prior to conception and during pregnancy [38]. These women have often been diagnosed with diabetes prior to their childbearing years and, because of their involvement with specialist services, should (although studies suggest this is not always the case [38]) have received advice about planning pregnancies and the importance of good glycaemic control. While the management of Type I diabetes is certainly important, Type II diabetes is a far more important issue for Pacific women. All women are screened for diabetes during pregnancy in New Zealand at 24-28 weeks. The work of Cundy et al suggests that a number of Pacific women are likely to have undiagnosed Type II diabetes prior to pregnancy [39]. Identifying women at high risk of type two diabetes in child bearing years, screening these women and offering them appropriate counselling prior to pregnancy may be another way to improve pregnancy outcomes for Pacific women.

Obesity

As discussed above, obesity has been shown to be an independent risk factor for fetal death in international studies [35]. There is a higher prevalence of obesity among Pacific women compared to other women in New Zealand. Over 40% of Pacific women were classified as being obese (BMI >32) in the 2003 National Health survey[77]. A New Zealand cross sectional study found even higher rates of obesity with 72% of Pacific women (>40 years) found to have a BMI >30kg/m^2 [78]. Another recent New Zealand study found that the average BMI for pregnant women identifying as Samoan or Tongan was 31kg/ m^2 [61].

Obesity has been recognized as a risk factor for a number of diseases including heart disease and diabetes. The previous government identified obesity as one of the top ten health targets as part of the *Improve Nutrition, Increase Physical Activity and Decrease Obesity* target[79] . In response to this a number of strategies have been developed. including Healthy Eating; Healthy Action [80]. Including information about the association between stillbirth and obesity

may strengthen the message that maintaining a healthy weight through healthy eating and regular exercise is important for the health and wellbeing of Pacific peoples.

Smoking

Smoking, like obesity, is an important modifiable risk factor for stillbirth. A recent article summarized results of the 2006 New Zealand census and reported that between 21.3%-37.8% of Pacific women of childbearing age are regular smokers. This varied by age group as follows; 15-19 years 21.3%; 20-24 years 37.8%; 25-29 years 36.6%; 30-39 years 31.3% [81]. A higher percentage of Pacific women smoked than European women for each age bracket. Smoking rates for Māori were however higher than both Pacific and European women [81].

Reducing harm caused by tobacco is a key Health Target championed by the Ministry of Health [79, 81]. Cnattingius and Lambe looked at trends in smoking during pregnancy and suggest that most women are concerned about the risk that smoking confers to their fetus and therefore women who continue to smoke during pregnancy are likely to be the ones most addicted to nicotine[24]. They argue however that routine antenatal visits combined with maternal concern over fetal wellbeing is an ideal opportunity to promote smoking cessation [24]. A Cochrane review has been undertaken which looks specifically at interventions that aim to decrease smoking during pregnancy [82]. The review included 64 trials and of these 51 were randomized controlled trials. There was a significant reduction in smoking in the intervention group in 48 of the included trials. The authors concluded that smoking cessation programmes in pregnancy have the potential to reduce the proportion of women who continue to smoke [82].

Monitoring Fetal Growth

Poor fetal growth has been found to be associated with stillbirth and many classification systems now consider it a cause of fetal death. It has been established that customized birth weight percentile charts and fetal growth curves that adjust for maternal characteristics, including ethnicity, are better at identifying babies that are growth restricted and thus warrant close monitoring because of the increase risk of fetal death [61]. The Euronatal Study identified the lack of detection of IUGR as the single largest contributor to stillbirths [1]. As previously discussed, ethnic specific fetal growth charts have recently been developed for use in New Zealand [61] and while large scale studies are necessary to determine whether the use of customized charts can reduce fetal deaths, it is hoped they will improve identification of at risk fetuses so that they can be closely monitored and, if necessary delivered pre-emptively.

In Summary

Strategies to reduce fetal deaths require a multi-faceted approach including adequate access to high quality care pre-conception, antenatally and during labour [18]. In addition, perinatal death reviews are of value in ensuring that key learning points can be gleaned from each death [72], so that deaths of a similar nature can be avoided in future.

From the above review there are a number of risk factors for fetal deaths common in Pacific women of childbearing age. Obesity and cigarette smoking are considered two of the major modifiable risk factors for stillbirth and are both more prevalent in Pacific compared to European women in New Zealand. The available evidence suggests that Type II diabetes is probably under recognized in Pacific women and this may confer an increase risk of stillbirth.

While more research is needed into the mechanisms that are responsible for the high rates of late fetal death in Pacific women, the evidence suggests that strategies that are effective at reducing obesity; increasing smoking cessation as well as identifying and managing type II diabetes early; may have an important role in decreasing the risk of stillbirth in Pacific women. It should be reiterated that access to acceptable prenatal and antenatal care is vital to ensure that Pacific women have the best possible change to conceive, and deliver, a healthy infant.

Preterm Birth

Introduction

Preterm birth is defined as the birth of a baby <37 weeks completed gestation [83], with gestational age being defined as the number of completed weeks since the first day of the last menstrual period, although if this date is unknown, ultrasound measurements may provide an estimate (+/- 1 week) if undertaken in the first 20 weeks of pregnancy.

Preterm deliveries comprise a heterogeneous group, and are often divided into three distinct categories [84]: (1) Idiopathic Preterm Births, where labour starts without apparent reason and without prior rupture of the membranes; (2) Preterm Premature Rupture of the Membranes, where the fetal membranes rupture prior the onset of labour, resulting in preterm delivery; and (3) Iatrogenic Preterm Births, where delivery is induced for a variety of reasons including pre-eclampsia, diabetes or antepartum haemorrhage.

In the overseas literature, iatrogenic preterm births account for approximately 25% of deliveries <37 weeks gestation. In the majority of cases, continuation of pregnancy poses an unacceptably high risk to the mother or fetus [85] and early delivery is indicated. In contrast, spontaneous preterm births account for 75% of deliveries <37 weeks gestation, with approximately two thirds being due to preterm labour and one third being due to premature rupture of the membranes [85].

In New Zealand during the late 1990s preterm birth rates increased, although rates for Pacific women remained lower than for European women [2]. Amongst Pacific women however, preterm birth rates were significantly higher for teenagers, although no marked socioeconomic gradients were evident (in contrast to European women, where preterm birth rates were 1.21 times higher for women living in NZDep Decile 10 vs. Decile 1 areas) [2]. While infants born prematurely have higher neonatal mortality and morbidity, it is difficult to determine whether New Zealand's rising preterm rates will have any detrimental impacts, as it remains unclear whether these increases are due to increasing obstetric intervention and the selective delivery of high risk babies (as is occurring overseas), or whether they reflect a true rise in spontaneous preterm birth.

The following section explores preterm birth rates amongst Pacific babies in New Zealand using information from the Birth Registration Dataset, before reviewing a range of policy and evidence based review documents which consider how the issue of preterm birth might be addressed at the population level.

Data Sources and Methods

Definition
Babies born <37 weeks completed gestation

Data Source
Numerator: Birth Registration Dataset: All singleton live born babies 20-36 weeks gestation
Denominator: Birth Registration Dataset: All singleton live born babies registered 20+ weeks gestation

Notes on Interpretation
Note 1: See Appendix 5: The Birth Registration Dataset for an overview of the data source used.
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

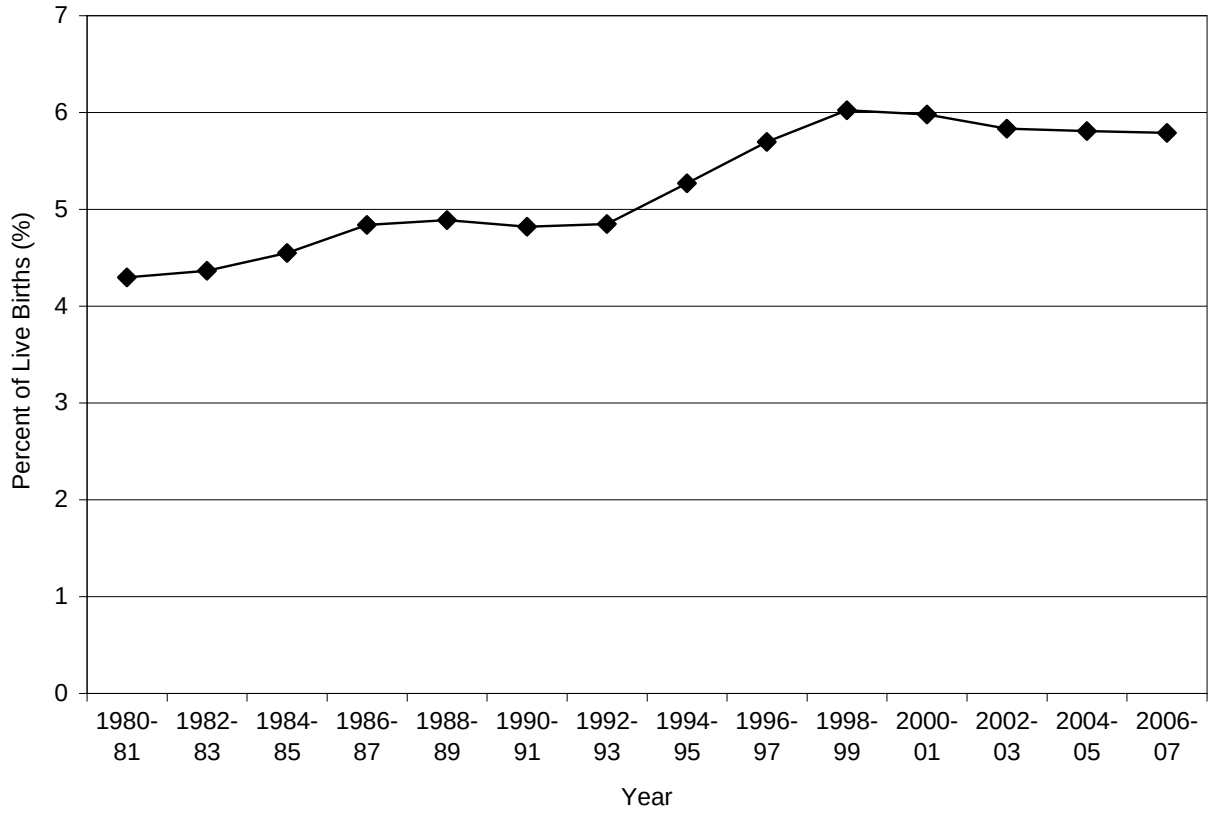
Indicator Category Ideal B-C

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1980-2007, preterm birth rates increased, with the most rapid increases occurring during the late 1990s. Rates reached a peak in 1998-1999 and then declined slightly (**Figure 6**).

Figure 6. Preterm Birth Rates in Singleton Live Born Babies, New Zealand 1980-2007



Source: Birth Registration Dataset.

Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

In New Zealand during 2003-2007, preterm birth rates for Pacific babies were similar to those for European and Asian babies, but *significantly lower* than for Māori babies. Preterm birth rates were also *significantly higher* for males and those in more deprived or urban areas (**Table 8**).

Ethnic Specific Trends

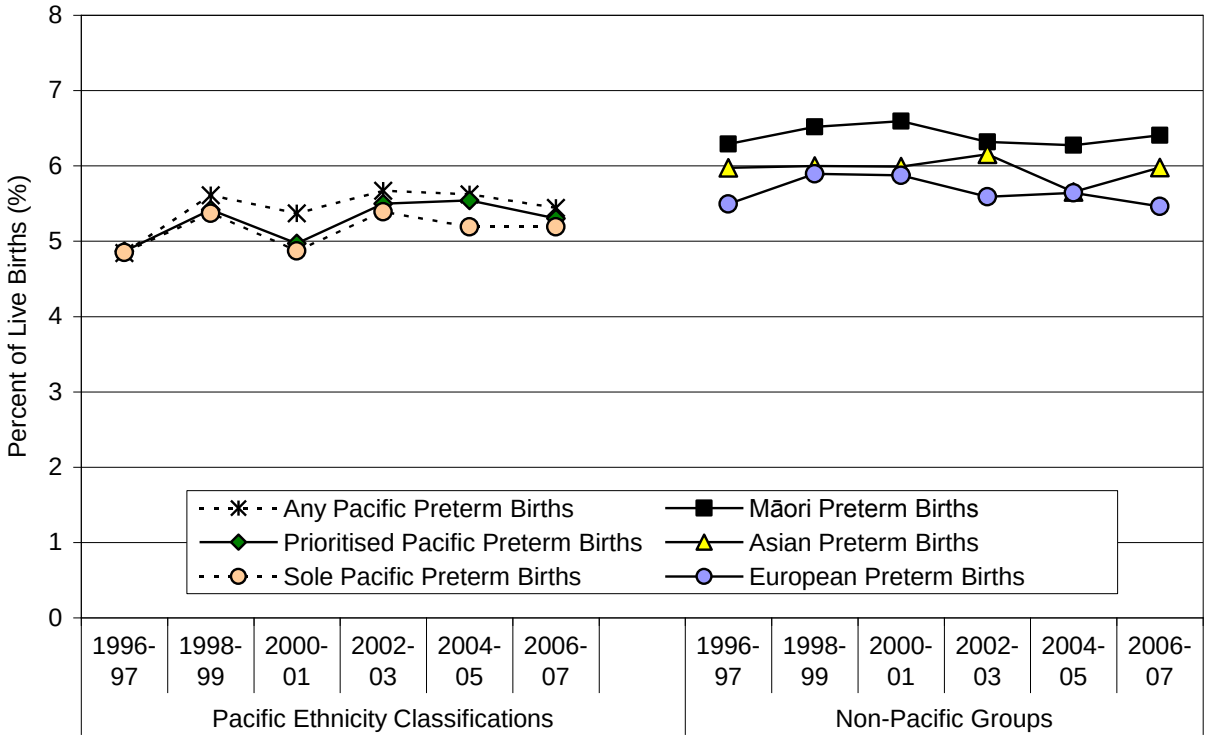
In New Zealand during 1998-2007, preterm birth rates were higher for Any Pacific than for Sole Pacific babies (**Figure 7**).

Table 8. Risk Factors for Preterm Birth, New Zealand Singleton Live Births 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	5.32	1.00		1-2	5.31	1.00	
2	5.30	1.00	0.92 - 1.08	3-4	5.28	0.99	0.94 - 1.05
3	5.07	0.95	0.88 - 1.03	5-6	5.78	1.09	1.03 - 1.15
4	5.46	1.03	0.95 - 1.11	7-8	6.06	1.14	1.09 - 1.20
5	5.84	1.10	1.02 - 1.18	9-10	6.15	1.16	1.10 - 1.21
6	5.72	1.08	1.00 - 1.16	Prioritised Ethnicity			
7	6.20	1.17	1.08 - 1.25	European	5.54	1.00	
8	5.94	1.12	1.04 - 1.20	Māori	6.31	1.14	1.10 - 1.18
9	6.04	1.14	1.06 - 1.22	Pacific	5.51	1.00	0.95 - 1.05
10	6.24	1.17	1.10 - 1.26	Asian	5.85	1.06	1.00 - 1.11
Gender				Urban / Rural			
Female	5.48	1.00		Urban	5.87	1.00	
Male	6.08	1.11	1.08 - 1.14	Rural	5.19	0.88	0.84 - 0.93

Source: Birth Registration Dataset. Note: Rate per 100 singleton live births per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted

Figure 7. Preterm Birth Rates by Baby's Ethnic Group, New Zealand Singleton Live Births 1996-2007



Source: Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Preterm Births amongst Pacific Groups in New Zealand

In New Zealand during 2003-2007 (using the Sole / Any classification), preterm birth rates were *significantly higher* for Sole and Any Cook Island Māori and Other Pacific babies than they were for non-Māori non-Pacific babies. In contrast, preterm birth rates for Sole Samoan and Any Tongan babies were *significantly lower* than for non-Māori non-Pacific babies (**Table 9**).

Summary

In New Zealand during 1980-2007, preterm birth rates increased, with the most rapid increases occurring during the late 1990s. Rates peaked in 1998-1999 and since then have declined slightly. During 2003-2007, preterm birth rates for Pacific babies were similar to those for European and Asian babies, but *significantly lower* than for Māori babies. Preterm birth rates were also *significantly higher* for males and those in more deprived or urban areas. During the same period (using the Sole / Any classification), preterm birth rates were *significantly higher* for Sole and Any Cook Island Māori and Other Pacific babies than for non-Māori non-Pacific babies. In contrast, preterm birth rates for Sole Samoan and Any Tongan babies were *significantly lower* than for non-Māori non-Pacific babies.

Table 9. Distribution of Preterm Births by Pacific Group, Singleton Live Births in New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 100 (%)	RR	95% CI
Any Samoan	1,172	234.4	5.26	0.94	0.89-1.00
Any Tongan	494	98.8	5.04	0.90	0.83-0.99
Any Cook Island Māori	676	135.2	6.48	1.16	1.08-1.25
Any Niuean	215	43.0	5.60	1.00	0.88-1.14
Any Fijian	88	17.6	6.31	1.13	0.92-1.38
Any Tokelauan	77	15.4	6.95	1.24	1.00-1.54
Any Other Pacific	102	20.4	7.10	1.27	1.05-1.53
Any Pacific	2,475	495.0	5.62	1.01	0.96-1.05
Any Māori	5,293	1,058.6	6.31	1.13	1.09-1.17
Non-Māori Non-Pacific	9,760	1,952.0	5.59	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 100 (%)	RR	95% CI
Sole Samoan	448	89.6	4.60	0.82	0.75-0.90
Sole Tongan	259	51.8	5.26	0.94	0.84-1.06
Sole Cook Island Māori	190	38.0	6.84	1.22	1.07-1.41
Sole Niuean	36	7.2	6.69	1.20	0.87-1.64
Sole Fijian	19	3.8	7.22	1.29	0.84-1.99
Sole Tokelauan	10	2.0	3.83	0.69	0.37-1.26
Sole Other Pacific	53	10.6	7.89	1.41	1.09-1.83
Sole Pacific	1,016	203.2	5.29	0.95	0.89-1.01
Sole Māori	2,278	455.6	7.12	1.27	1.22-1.33
Non-Māori Non-Pacific	9,760	1,952.0	5.59	1.00	

Source: Birth Registration Dataset. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); RR: Rate ratios are compared to the Non-Māori Non-Pacific group and are unadjusted

Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Spontaneous Preterm Birth

Preterm delivery is a major cause of perinatal morbidity, mortality and long-term adverse neuro-developmental outcome. Given its heterogeneous aetiology, and the fact that in many cases of iatrogenic preterm birth, the risk of in-utero fetal demise means that the prevention of preterm delivery may not be the primary consideration, developing a single strategy for the prevention of preterm births in their entirety remains problematic. In New Zealand, there is no single strategy for the prevention of spontaneous preterm birth, and thus any local strategies developed need to incorporate evidence from a variety of sources. **Table 10** provides an overview of publications which may be useful in this context. A brief perusal of this table however, suggests that at present (with the exception of interventions to address specific risk factors such as smoking), there is a paucity of evidence based solutions for the prevention of spontaneous preterm birth and thus further research may be required, before comprehensive solutions to this issue can be developed.

Table 10. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Spontaneous Preterm Birth

Ministry of Health Policy Documents
In New Zealand there are no policy documents which focus specifically on the prevention of preterm birth. However a range of Government policy documents exist which consider approaches to sexual and reproductive health, the provision of maternity services, or the management of known risk factors (e.g. smoking, sexually transmitted infections) more generally. These are reviewed in other sections of this report as follows: • Publications which relate to **Sexual and Reproductive Health** are reviewed in **Table 106** on **Page 305** • Publications which relate to the **Provision of Maternity Care** are reviewed in Error! Reference source not found. on **Page** Error! Bookmark not defined. • Publications which relate to **Tobacco Control / Smoking** are reviewed in **Table 32** on **Page 120** • Publications which relate to **Sexually Transmitted Infections** are reviewed in **Table 113** on **Page 326**
Systematic and Other Reviews from the International Literature
Swadpanich U, Lumbiganon P, Prasertcharoensook W, Laopaiboon M. **Antenatal Lower Genital Tract Infection Screening and Treatment Programmes for Preventing Preterm Delivery.** Cochrane Database of Systematic Reviews 2008, Issue 2. This review found that a simple infection screening and treatment programme during routine antenatal care could reduce preterm births and preterm low (<2,500 g) and very low (<1,500 g) birth weight. These findings however, were based on only one study which was of high methodological quality. It reported on 4,155 women randomly assigned either to an intervention group (where the results of infection screening were reported) or a control group (where the results were not reported). The authors concluded that infection screening and treatment programmes in pregnant women may reduce preterm birth and preterm low birth weight, but that future trials would need to evaluate the effectiveness of the type of screening programme used, the gestational age of screening, and the costs of introducing an infection screening programme.
McDonald HM, Brocklehurst P, Gordon A. **Antibiotics for Treating Bacterial Vaginosis in Pregnancy**. Cochrane Database of Systematic Reviews 2007, Issue 1. This review assessed the effects of antibiotic treatment of bacterial vaginosis in pregnancy and found little evidence to support the screening and treatment of all pregnant women with asymptomatic bacterial vaginosis to prevent preterm birth. There was some suggestion however that treatment <20 weeks gestation may reduce the risk of preterm birth. The authors suggested this needed to be further verified in future trials.
Mahomed K, Bhutta Z, Middleton P. **Zinc Supplementation for Improving Pregnancy and Infant Outcome**. Cochrane Database of Systematic Reviews 2007, Issue 2. Low zinc levels may cause preterm birth, prolong labour and possibly also affect infant growth. This review of 17 trials, involving >9,000 women and their babies, found that although zinc supplementation had a small effect on reducing preterm births, it did not prevent low birth weight. The authors concluded that improving women's overall nutritional status, particularly in low-income areas, would do more to improve the health of mothers and babies than supplementing pregnant women with zinc.
Dodd J, Flenady V, Cincotta R, Crowther C. **Prenatal Administration of Progesterone for Preventing Preterm Birth**. Cochrane Database of Systematic Reviews 2006, Issue 1. This review considered trials assessing the benefits and harms of progesterone administration during pregnancy to prevent preterm birth. It found that where progesterone was given (via IM injection in some studies and vaginal pessary in another), there were beneficial effects, including prolonging the pregnancy, but there was insufficient information about potential harms.
Makrides M, Duley L, Olsen S. Marine **Oil and Other Prostaglandin Precursor Supplementation for Pregnancy Uncomplicated by Pre-Eclampsia or Intrauterine Growth Restriction**. Cochrane Database of Systematic Reviews 2006, Issue 3. This review estimated the effects of marine oil and other prostaglandin precursor supplementation during pregnancy on the risk of pre-eclampsia, preterm birth, low birth weight and small-for-gestational age. It identified six trials involving 2755 women and found that fish / marine oil supplements taken in pregnancy increased the length of pregnancy by 2-3 days, slightly increased baby's birth weight and slightly reduced the number of babies born <34 weeks gestation. However, these small effects did not reduce the overall risk of a baby being born too soon or too small, or of the mother developing pre-eclampsia. It is likely that a larger sample size will be needed to address this question more fully, or to answer the question of whether supplementation is harmless.

Raynes-Greenow C, Roberts C, Bell J, et al. **Antibiotics for Ureaplasma in the Vagina in Pregnancy**. Cochrane Database of Systematic Reviews 2004, Issue 1.

This review considered whether antibiotic treatment of pregnant women with ureaplasma in the vagina reduced the incidence of preterm birth or other adverse pregnancy outcomes. The reviewers identified only one eligible trial and concluded that there was insufficient data to determine whether giving antibiotics to women with ureaplasma made any difference to the risk of preterm birth.

Lumley J, Oliver S, Chamberlain C, Oakley L. **Interventions for Promoting Smoking Cessation During Pregnancy.** Cochrane Database of Systematic Reviews 2004, Issue 4.

This review found that smoking cessation programmes in pregnancy reduce the proportion of women who continue to smoke, and reduce low birth weight and preterm birth. The pooled trials however had inadequate power to detect reductions in perinatal mortality or very low birth weight.

Hodnett ED, Fredericks S. **Support During Pregnancy for Women at Increased Risk of Low Birth weight Babies.** Cochrane Database of Systematic Reviews 2003, Issue 3.

This review assessed the effects of programmes offering additional social support to pregnant women at risk of preterm birth or low birth weight. Eighteen trials, involving 12,658 women, were included, with the trials being generally of good to excellent quality, (although 3 used allocation methods likely to introduce bias). Programmes offering additional social support for at-risk pregnant women were not associated with improvements in perinatal outcomes, but there was a reduction in the likelihood of caesarean birth and an increased likelihood of elective termination of pregnancy. Some improvements in immediate maternal psychosocial outcomes were found in individual trials.

Bull J, Mulvihill C, Quigley, R. **Prevention of Low Birth Weight: Assessing the Effectiveness of Smoking Cessation and Nutritional Interventions. Evidence Briefing.** 2003, Health Development Agency. http://www.nice.org.uk/niceMedia/documents/ low_birth_weight_evidence_briefing.pdf

This evidence briefing focused on the effectiveness of smoking cessation and nutritional interventions for the prevention of low birth weight. The evidence was derived primarily from good quality systematic reviews and meta-analyses published since 1996. The review is intended to inform policy and decision makers, public health physicians and other public health practitioners and while written for a British audience, it contains information relevant to the New Zealand context.

Forthcoming Documents

Honest H, Forbes C, Durée K, Norman G, Tsourapas A, Roberts T, Hyde C, Duffy S, Khan K. **Screening to Prevent Pre-Term Birth - Systematic Reviews of Accuracy and Effectiveness Literature with Economic Modelling.** Health Technology Assessment 2008 [in press].
http://www.york.ac.uk/inst/crd/projects/preterm_birth.htm

Infant Mortality and Sudden Unexpected Death in Infancy (SUDI)

Introduction

Total Infant Mortality

Mortality during the first year of life is higher than at any other point during childhood or adolescence. In the year to March 2008, a total of 330 New Zealand infants died prior to their first birthday [86]. Despite these relatively high numbers, New Zealand's infant mortality rates have declined during the past 40 years, with rates falling from 18.2 per 1,000 in 1968, to 5.3 per 1,000 in March 2008 [86]. While infant mortality rates are generally higher for Pacific babies than for Māori > European / Other babies [87], total infant mortality rates alone are of limited utility in guiding population health interventions, as the causes of mortality differ markedly, depending on the age of the infant. During the neonatal period (birth-28 days) extreme prematurity, congenital anomalies and intrauterine / birth asphyxia are the leading causes of mortality, while in the post neonatal period (29-364 days) SIDS and congenital anomalies make the greatest contribution [88]. Thus any interventions aimed at reducing New Zealand's relatively high infant mortality rates must, in the first instance, be based on an understanding of their component causes.

Sudden Infant Death Syndrome (SIDS) and Sudden Unexpected Death in Infancy (SUDI)

Sudden Infant Death Syndrome (SIDS) is defined as "*the sudden unexpected death of an infant <1 year of age with onset of the fatal episode apparently occurring during sleep, that remains unexplained after a thorough investigation, including performance of a complete autopsy and review of the circumstances of death and the clinical history* [89]".

SIDS remains one of the leading causes of post-neonatal mortality for Pacific infants in New Zealand, with rates being intermediate between those of European and Māori infants [90]. While a large number of potentially modifiable risk factors for SIDS have been identified (e.g. placing babies on their fronts to sleep; cigarette smoking; a lack of breastfeeding [91] and bed sharing [92]), one recent survey of Pacific mothers (n=1,376) whose babies were 6 weeks of age found that over a third (38.8%) were unable to accurately report a SIDS risk factor, with only 53.4% identifying putting the baby to sleep in the prone position as a risk factor and only 31.5% identifying the risks associated with maternal smoking [93]. In addition while the issue of bed-sharing remains controversial, in the same cohort 50% of infants usually bed shared with their mother and 12% usually bed shared with a mother who smoked, despite solitary sleeping being advocated as best practice [94]. The authors concluded that more effective methods were required to provide consistent SIDS prevention information to Pacific families [93], and that mothers also required adequate information antenatally about the risks and benefits associated with room sharing, bed-sharing and safe sleeping practices [94].

In addition to the controversy surrounding bed sharing, new issues with the definition of SIDS have emerged, possibly as the result of pathologists and coroners becoming increasingly reluctant to label a death as SIDS in the context of equivocal death scene findings (e.g. infant co-sleeping with parental alcohol consumption [95]). This has resulted in a fall in the number of SIDS deaths, in the context of an increase in the number of deaths attributed to "*suffocation / strangulation in bed*" or "*unspecified causes*", leading some to create a new category of *Sudden Unexpected Death in Infancy* (SUDI) in an attempt to provide come consistency for measuring trends in the face of this probable diagnostic transfer [95].

The following section thus uses information from the National Mortality Collection to explore infant mortality rates in Pacific infants in New Zealand, before considering Sudden Unexpected Deaths in Infancy (SUDI) in more detail. The section concludes with a review of policy and evidence based review documents which consider approaches to addressing infant mortality and SUDI at the population level.

Data Source and Methods

Definition

1. Total Infant Mortality: Death of a live born infant prior to 365 days of life
2. Neonatal Mortality: Death of a live born infant prior to 29 days of life
3. Post-Neonatal Mortality: Death of a live born infant after 28 days but prior to 365 days of life
4. Sudden Unexpected Death in Infancy (SUDI): Death of a live born infant <365 days of life, where the cause of death is attributed to SIDS, Accidental Suffocation / Strangulation in Bed or Ill-Defined/Unspecified Causes

Data Sources

Numerator: National Mortality Collection: All deaths in the first year of life, using the definitions for total, neonatal and post neonatal mortality outlined above. Cause of death was derived from the main underlying cause of death (clinical code) using ICD-9 and 10 as follows: Extreme Prematurity (ICD-9 765.0; ICD-10 P072), Congenital Anomalies (ICD-9 740-759; ICD-10 Q00-Q99), Perinatal Conditions (ICD-9 760-779; ICD-10 P00-P96); SIDS (ICD-9 798.0; ICD-10 R95); SUDI (ICD-9 798.0, 798.2, 799.9; ICD-10 R95, W75, R99).
Denominator: Birth Registration Dataset: All live births 20+ weeks gestation.

Notes on Interpretation

Note 1: See *Appendix 5: The Birth Registration Dataset* and *Appendix 6: National Mortality Collection* for overviews of the datasets used.
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms significant or not significant have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category Ideal B

Total Infant Mortality

Total, Neonatal & Post-Neonatal Mortality Trends: New Zealand

In New Zealand during 1988-2005, total, neonatal and post-neonatal mortality all declined, with the most rapid declines occurring during the early-mid 1990s. Since 1998-99 however, total and neonatal mortality rates have become more static (**Figure 8**).

Infant Mortality by Cause: New Zealand Trends

In New Zealand during 1988-2005, SUDI mortality continued to decline, while mortality from congenital anomalies, after declining during the 1990s, was more static after 1998-99. In contrast, mortality from extreme prematurity increased, with the largest increases occurring during the early 2000s (**Figure 9**).

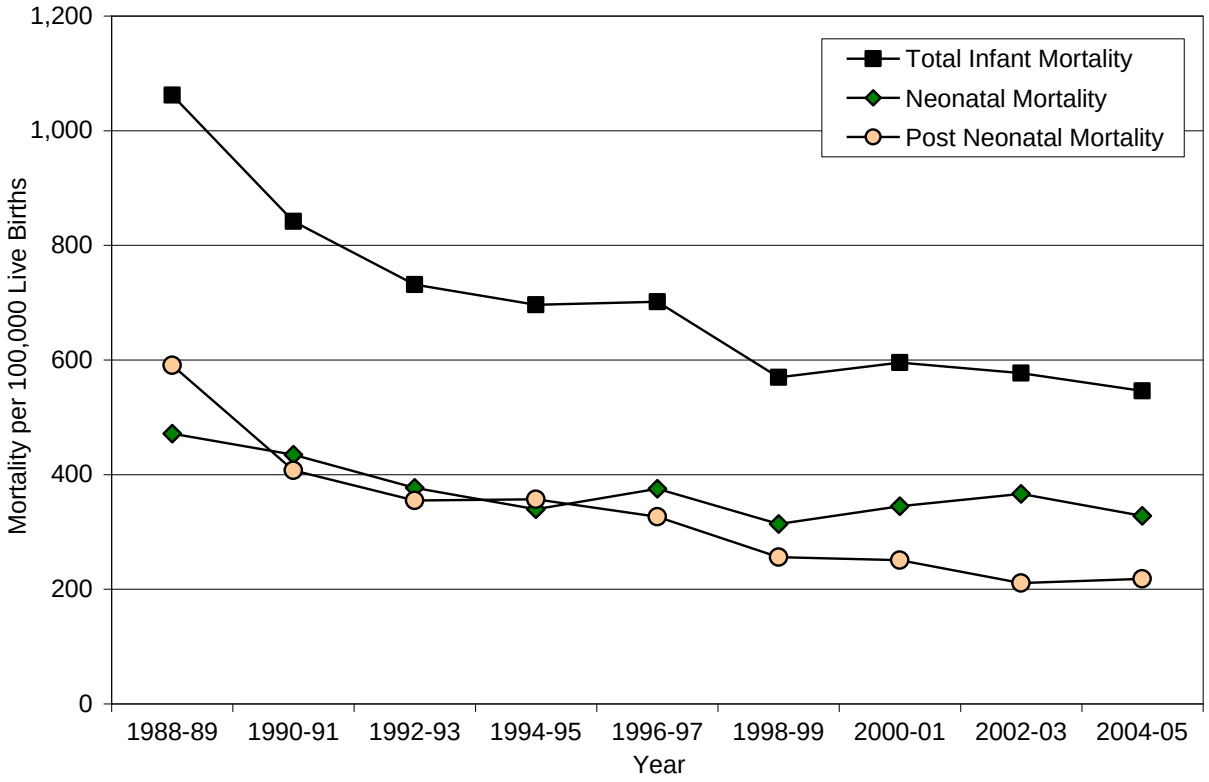
Total, Neonatal & Post-Neonatal Mortality: New Zealand Trends by Prioritised Ethnicity

In New Zealand during 1996-2005, total infant mortality rates were higher for Māori and Pacific > European > Asian infants. While post-neonatal mortality rates were consistently higher for Māori > Pacific > European and Asian infants, neonatal mortality rates for Māori and Pacific infants were more similar (although rates for both ethnic groups were generally higher than for European and Asian infants). While all ethnic groups saw declines in post-neonatal mortality, ethnic trends in neonatal mortality were less consistent (**Figure 10**).

Risk Factors for Infant Mortality Due to Congenital Anomalies and Extreme Prematurity

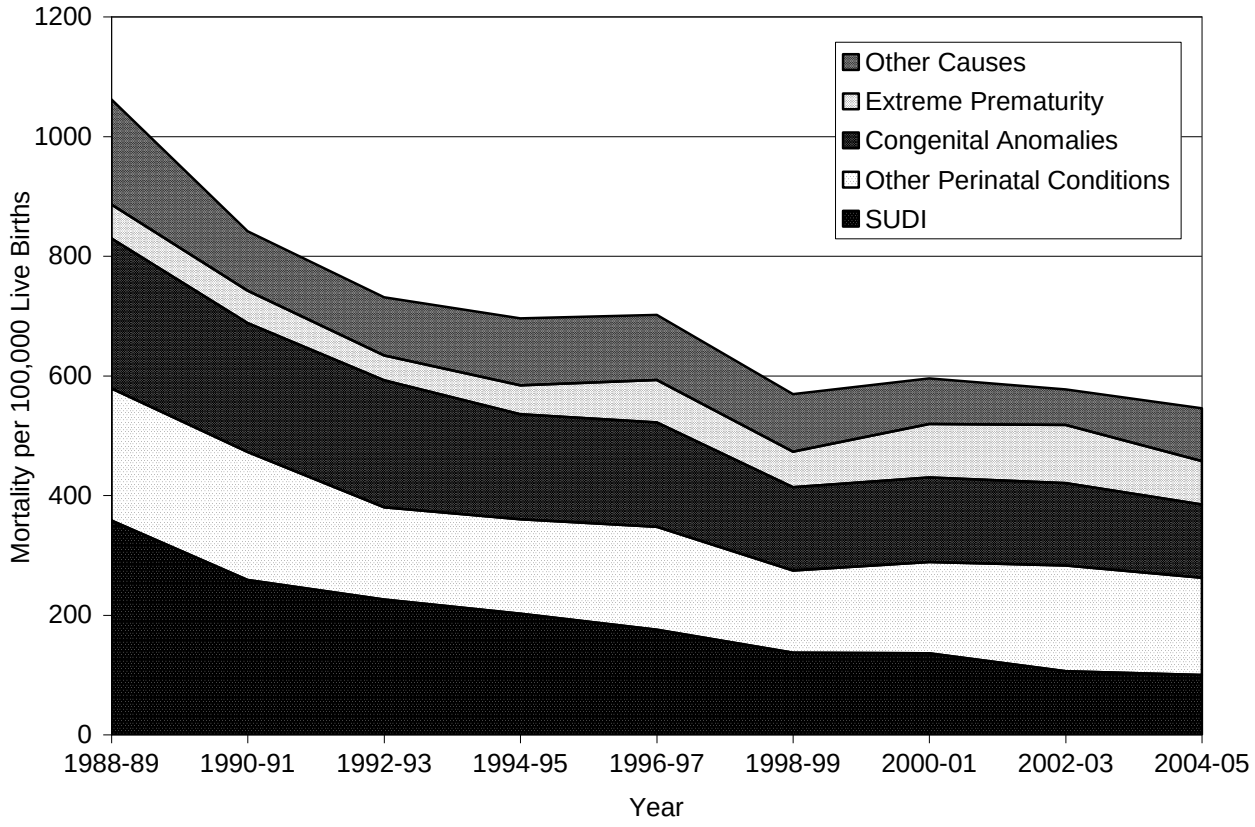
In New Zealand during 2001-2005, infant mortality from congenital anomalies was *significantly higher* for Pacific infants than for European infants. Mortality was also *significantly higher* for those living in the most deprived areas (**Table 11**). During the same period, mortality from extreme prematurity was *significantly higher* for Pacific and Māori infants than for European infants. Rates were also *significantly higher* for those living in more deprived or urban areas (**Table 12**).

Figure 8. Neonatal, Post-Neonatal and Total Infant Mortality, New Zealand 1988-2005



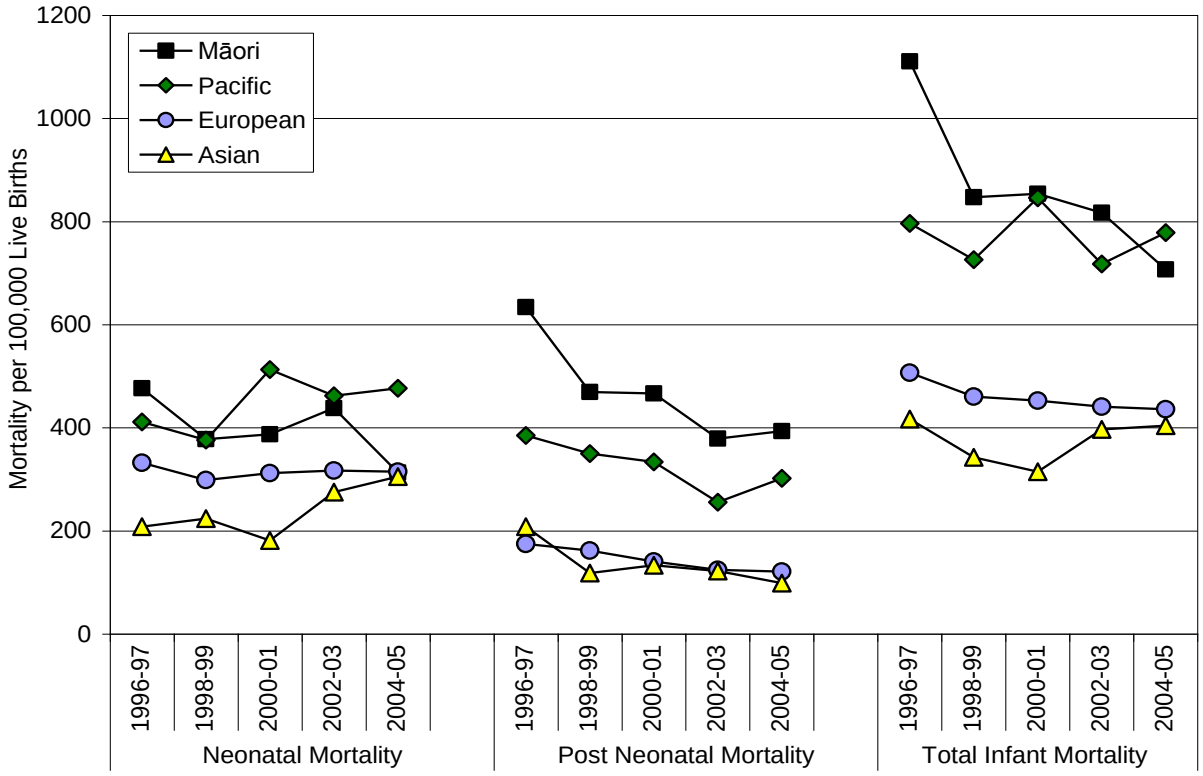
Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset.

Figure 9. Total Infant Mortality by Cause, New Zealand 1988-2005



Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset

Figure 10. Total, Neonatal and Post Neonatal Mortality by Ethnicity, New Zealand 1996-2005



Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Ethnicity is Level 1 Prioritised.

Table 11. Risk Factors for Infant Mortality due to Congenital Anomalies, New Zealand 2001-05

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Quintile				Prioritised Ethnicity			
1-2	104.42	1.00		European	122.64	1.00	
3-4	93.53	0.90	0.59 - 1.35	Māori	110.03	0.90	0.70 - 1.16
5-6	126.40	1.21	0.83 - 1.76	Pacific	175.06	1.43	1.05 - 1.94
7-8	129.02	1.24	0.86 - 1.78	Asian	131.97	1.08	0.74 - 1.56
9-10	151.22	1.45	1.03 - 2.04	Urban / Rural			
Gender				Urban	127.45	1.00	
Female	112.10	1.00		Rural	115.41	0.91	0.66 - 1.25
Male	138.05	1.23	1.00 - 1.52				

Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Table 12. Risk Factors for Infant Mortality due to Extreme Prematurity, New Zealand 2001-05

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Quintile				Prioritised Ethnicity			
1-2	56.75	1.00		European	53.74	1.00	
3-4	64.43	1.14	0.67 - 1.92	Māori	122.53	2.28	1.69 - 3.07
5-6	45.96	0.81	0.46 - 1.42	Pacific	126.44	2.35	1.60 - 3.45
7-8	98.37	1.73	1.09 - 2.76	Asian	83.98	1.56	0.97 - 2.53
9-10	130.18	2.29	1.48 - 3.56	Urban / Rural			
Gender				Urban	89.01	1.00	
Female	84.79	1.00		Rural	53.68	0.60	0.38 - 0.95
Male	83.79	0.99	0.77 - 1.27				

Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Neonatal Mortality

Neonatal Mortality by Cause

In New Zealand during 2001-2005, the most frequent causes of neonatal mortality for both Sole and Any Pacific infants were extreme prematurity and congenital anomalies, although intrauterine / birth asphyxia also made a small contribution (**Table 13**).

Table 13. Neonatal Mortality (0-28 days) by Cause, for Any and Sole Pacific vs. New Zealand Infants 2001-2005

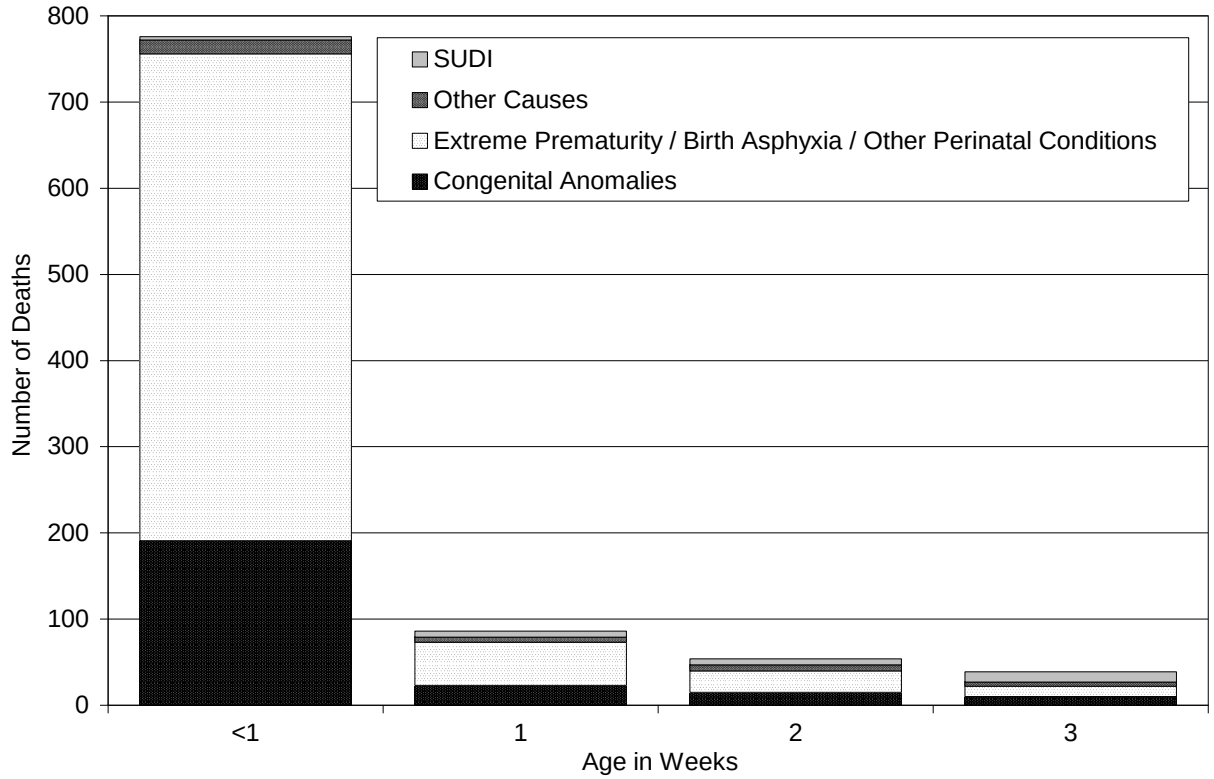
Cause of Death	Number: Total 2001-05	Number: Annual Average	Rate per 100,000	% of Deaths
Any Pacific				
Extreme Prematurity	48	9.6	112.66	28.4
Congenital Anomalies: CVS	11	2.2	25.82	6.5
Congenital Anomalies: CNS	5	1	11.74	3.0
Congenital Anomalies: Other	17	3.4	39.90	10.1
Intrauterine / Birth Asphyxia	9	1.8	21.12	5.3
SUDI: SIDS/Suffocation/Strangulation in Bed	5	1	11.74	3.0
Other Perinatal Conditions	67	13.4	157.26	39.6
All Other Causes	7	1.4	16.43	4.1
Total	169	33.8	396.67	100.0
Sole Pacific				
Extreme Prematurity	31	6.2	160.97	29.2
Congenital Anomalies: CVS	9	1.8	46.73	8.5
Congenital Anomalies: CNS	<5	s	s	s
Congenital Anomalies: Other	12	2.4	62.31	11.3
Intrauterine / Birth Asphyxia	6	1.2	31.16	5.7
SUDI: SIDS/Suffocation/Strangulation in Bed	<5	s	s	s
Other Perinatal Conditions	37	7.4	192.13	34.9
All Other Causes	5	1	25.96	4.7
Total	106	21.2	550.42	100.0
New Zealand				
Extreme Prematurity	239	47.8	83.93	24.8
Congenital Anomalies: CVS	71	14.2	24.93	7.4
Congenital Anomalies: CNS	29	5.8	10.18	3.0
Congenital Anomalies: Other	142	28.4	49.87	14.7
Intrauterine / Birth Asphyxia	50	10.0	17.56	5.2
SUDI: SIDS	15	3.0	5.27	1.6
SUDI: Suffocation/Strangulation in Bed	11	2.2	3.86	1.1
SUDI: Unspecified Cause	6	1.2	2.11	0.6
Other Perinatal Causes	368	73.6	129.23	38.1
Other Causes	34	6.8	11.94	3.5
Total	965	193.0	338.88	100.0

Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); CNS: central nervous system; CVS: cardiovascular system; SIDS: Sudden Infant Death Syndrome; SUDI: Sudden Unexpected Death in Infancy; s: small numbers preclude rate calculation.

Distribution by Age and Cause

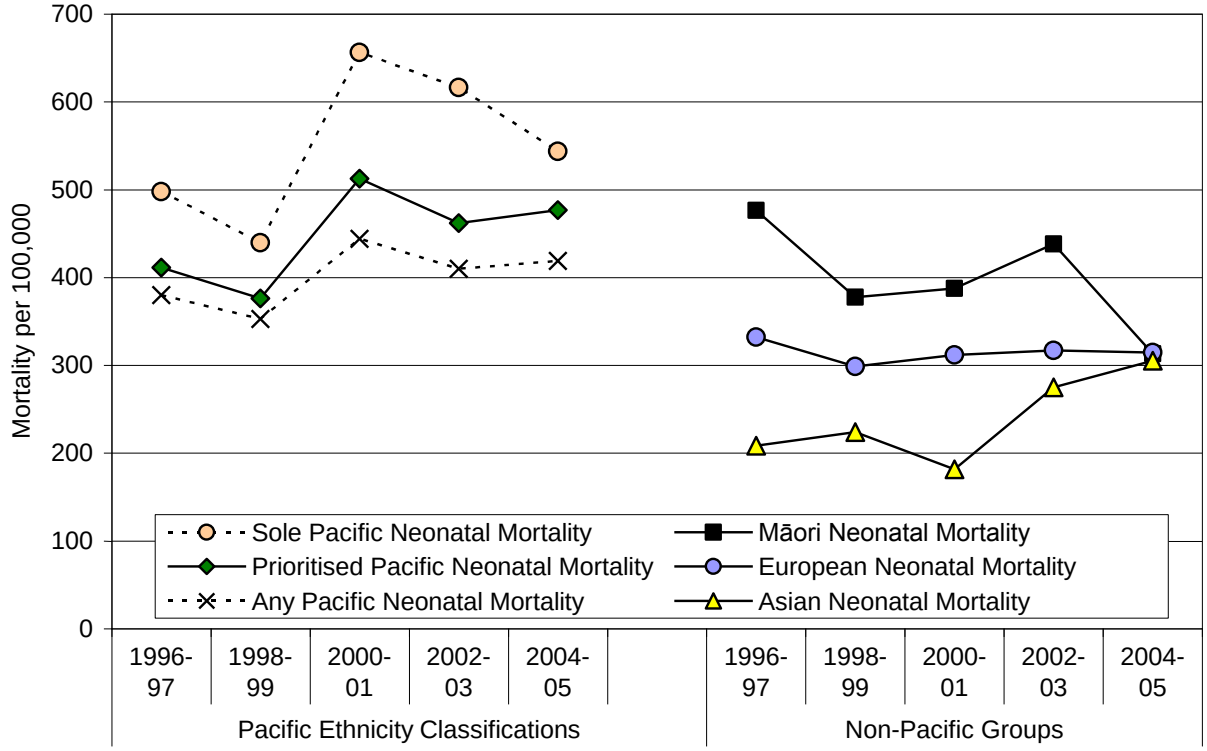
In New Zealand during 2001-2005, neonatal mortality was highest during the first week of life, with the number of deaths dropping off markedly thereafter (**Figure 11**).

Figure 11. Infant Mortality (0-3 Weeks) by Age and Cause, New Zealand 2001-2005



Source: National Mortality Collection; Numbers are per 5 year period.

Figure 12. Neonatal Mortality Rates by Ethnicity, New Zealand 1996-2005



Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Ethnicity for Non-Pacific Groups is Level 1 Prioritised; Ethnicity for Pacific Groups also assigned using Any/Sole Classification.

Ethnic Trends

In New Zealand during 1996-2005, neonatal mortality was consistently higher for Sole than for Any Pacific infants, although large year to year fluctuations made precise interpretation of trends difficult (**Figure 12**).

Post-Neonatal Mortality

Post-Neonatal Mortality by Cause

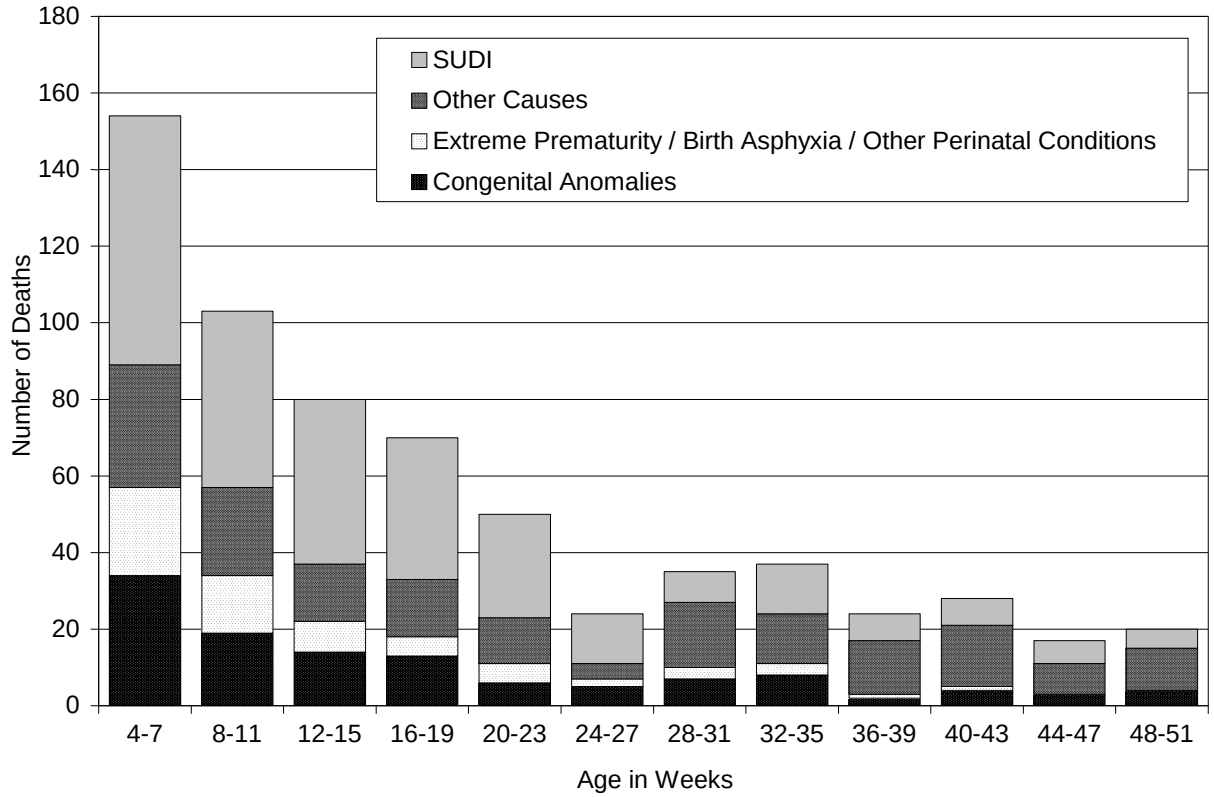
In New Zealand during 2001-2005, the single most frequent cause of post-neonatal mortality for both Any and Sole Pacific infants was SIDS, although a number of deaths were also attributed to suffocation / strangulation in bed and unspecified causes. Congenital anomalies also made a significant contribution in this age group (**Table 14**).

Table 14. Post-Neonatal Mortality (29-364 days) by Cause, Any and Sole Pacific vs. New Zealand Infants 2001-2005

Cause of Death	Number: Total 2001-05	Number: Annual Average	Rate per 100,000	% of Deaths
Any Pacific				
SUDI: SIDS	21	4.2	49.29	17.2
SUDI: Suffocation/Strangulation in Bed	15	3.0	35.21	12.3
SUDI: Unspecified	7	1.4	16.43	5.7
Congenital Anomalies: CNS	10	2.0	23.47	8.2
Congenital Anomalies: CVS	8	1.6	18.78	6.6
Congenital Anomalies: Other	11	2.2	25.82	9.0
Injury / Poisoning	6	1.2	14.08	4.9
Other Perinatal Conditions	11	2.2	25.82	9.0
Other Causes	33	6.6	77.46	27.0
Total	122	24.4	286.35	100.0
Sole Pacific				
SUDI: SIDS	10	2.0	51.93	14.7
SUDI: Suffocation/Strangulation in Bed	5	1.0	25.96	7.4
SUDI: Unspecified	<5	s	s	s
Congenital Anomalies: CNS	9	1.8	46.73	13.2
Congenital Anomalies: CVS	6	1.2	31.16	8.8
Congenital Anomalies: Other	6	1.2	31.16	8.8
Injury / Poisoning	<5	s	s	s
Other Perinatal Conditions	6	1.2	31.16	8.8
Other Causes	22	4.4	114.24	32.4
Total	68	13.6	353.10	100.0
New Zealand				
SUDI: SIDS	195	39.0	68.48	30.9
SUDI: Suffocation/Strangulation in Bed	55	11.0	19.31	8.7
SUDI: Unspecified	25	5.0	8.78	4.0
Congenital Anomalies: CVS	43	8.6	15.10	6.8
Congenital Anomalies: CNS	19	3.8	6.67	3.0
Congenital Anomalies: Other	54	10.8	18.96	8.5
Injury / Poisoning	31	6.2	10.89	4.9
Other Perinatal Conditions	61	12.2	21.42	9.7
Other Causes	149	29.8	52.32	23.6
Total	632	126.4	221.94	100.0

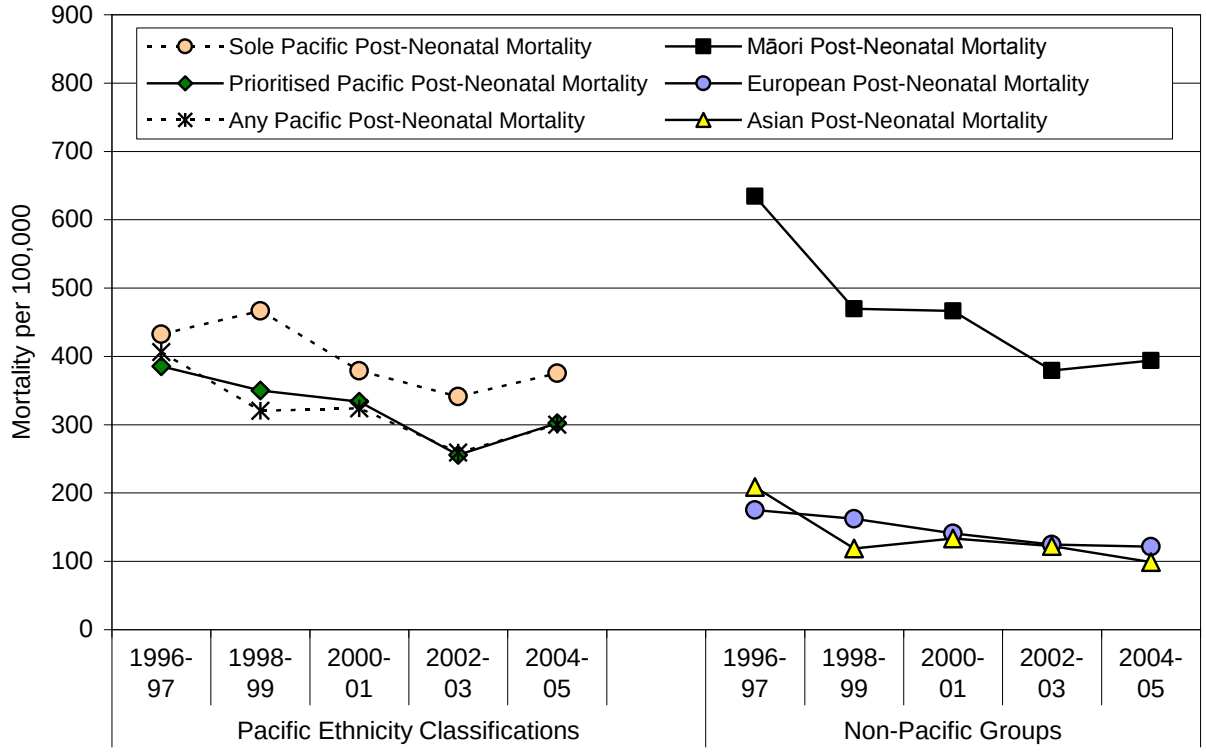
Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); CNS: central nervous system; CVS: cardiovascular system; SIDS: Sudden Infant Death Syndrome; SUDI: Sudden Unexpected Death in Infancy; s: small numbers preclude rate calculation.

Figure 13. Infant Mortality (4-51 Weeks) by Age and Cause, New Zealand 2001-2005



Source: National Mortality Collection; Numbers are per 5 year period.

Figure 14. Post-Neonatal Mortality Rates by Ethnicity, New Zealand 1996-2005



Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Distribution by Age and Cause

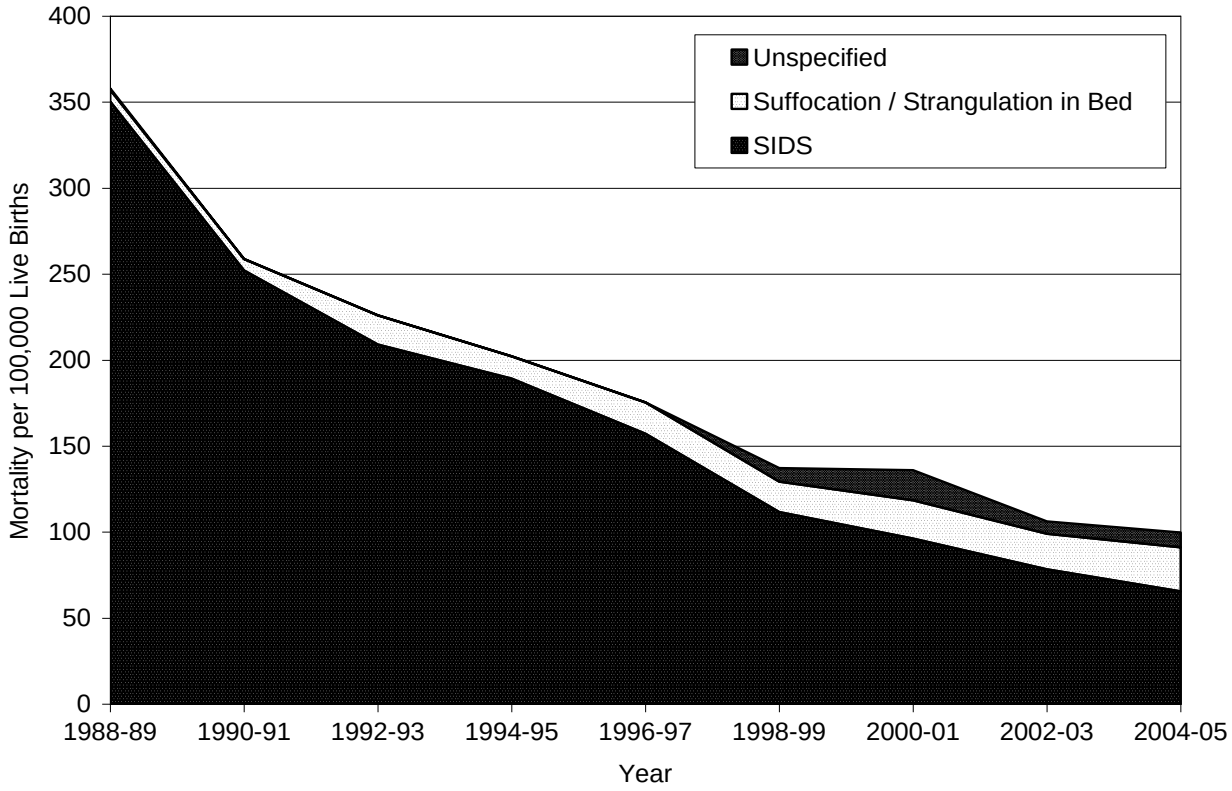
In New Zealand during 2001-2005 (after 3 weeks of age), mortality was highest for those aged 4-7 weeks, with the number of deaths then declining until 24-27 weeks, after which time mortality became relatively static (**Figure 13**).

Ethnic Trends
In New Zealand during 1996-2005, post-neonatal mortality rates were consistently higher for Sole than for Any Pacific infants (**Figure 14**).

Sudden Unexpected Death in Infancy (SUDI)

New Zealand Trends
In New Zealand during 1988-2005, SIDS rates continued to decline, although increases in the number of babies dying as a result of suffocation / strangulation in bed, or due to unspecified causes, meant that declines in overall SUDI rates were not as marked as those for SIDS during this period (**Figure 15**).

Figure 15. Sudden Unexpected Death in Infancy and its Component Causes, New Zealand 1988-2005



Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset

Table 15. Risk Factors for Infant Mortality due to Sudden Unexpected Death in Infancy, New Zealand 2001-2005

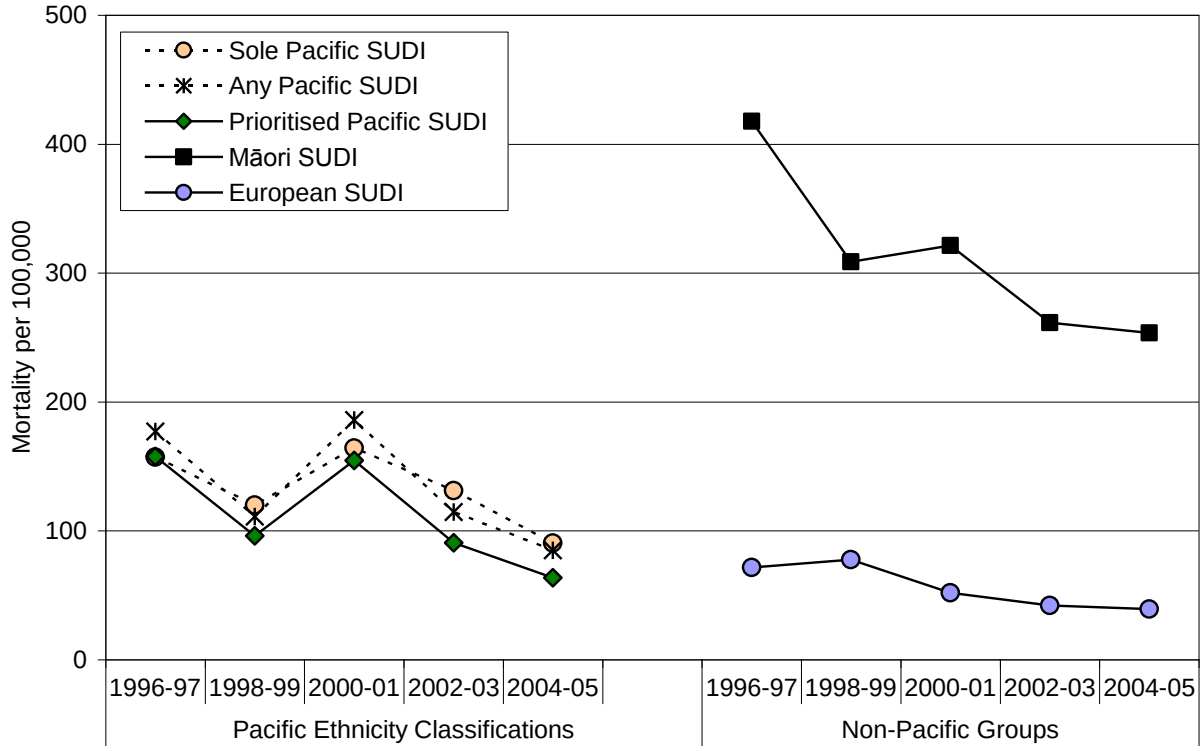
Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Quintile				Prioritised Ethnicity			
1-2	24.97	1.00		European	41.34	1.00	
3-4	70.66	2.83	1.43 - 5.58	Māori	267.57	6.47	4.86 - 8.62
5-6	70.86	2.84	1.45 - 5.56	Pacific	87.53	2.12	1.34 - 3.33
7-8	103.21	4.13	2.18 - 7.84	Asian	20.00	0.48	0.19 - 1.20
9-10	211.70	8.48	4.60 - 15.61	Urban / Rural			
Gender				Urban	112.48	1.00	
Female	100.60	1.00		Rural	77.83	0.69	0.47 - 1.01
Male	114.69	1.14	0.91 - 1.43				

Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset; Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Distribution

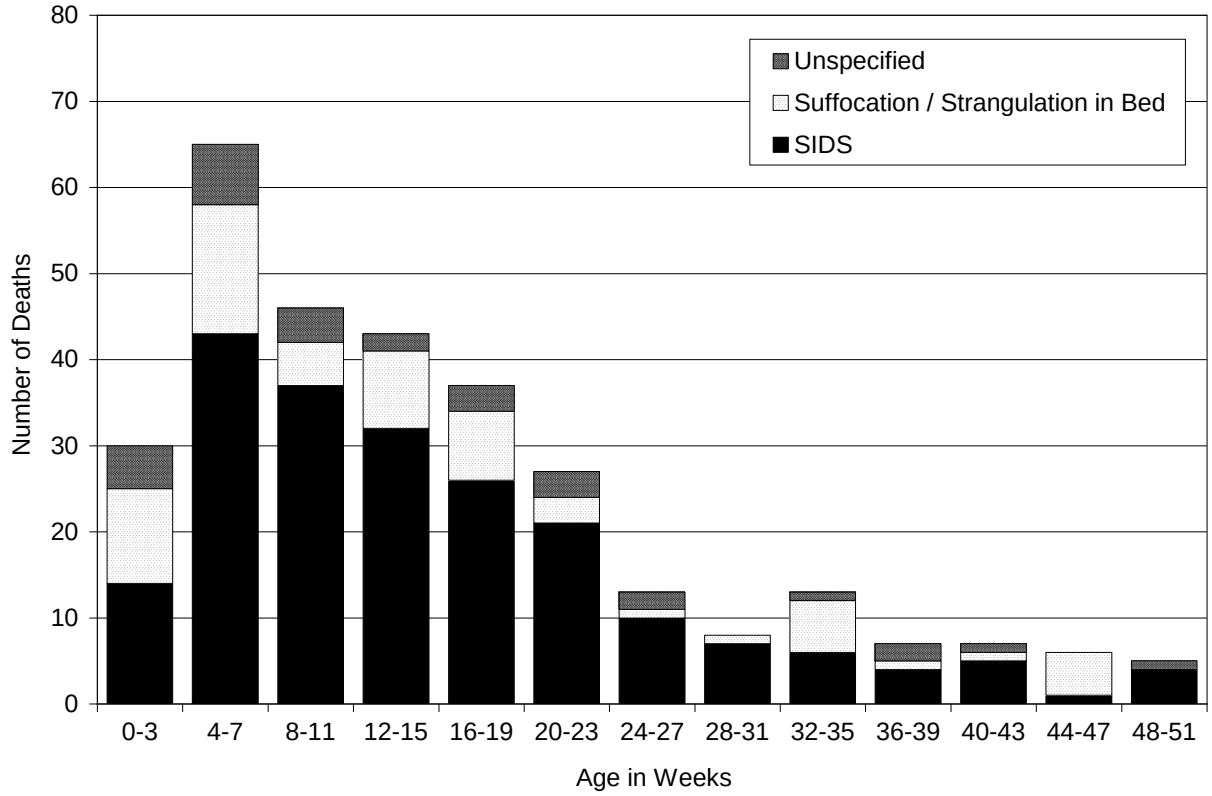
In New Zealand during 2001-2005, SUDI mortality was *significantly higher* for Māori > Pacific > European and Asian infants and those living in the more deprived areas (**Table 15**).

Figure 16. Sudden Unexpected Death in Infancy by Ethnicity, New Zealand 1996-2005



Source: Numerator-National Mortality Collection; Denominator-Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 17. Sudden Unexpected Death in Infancy by Age and Cause, New Zealand 2001-2005



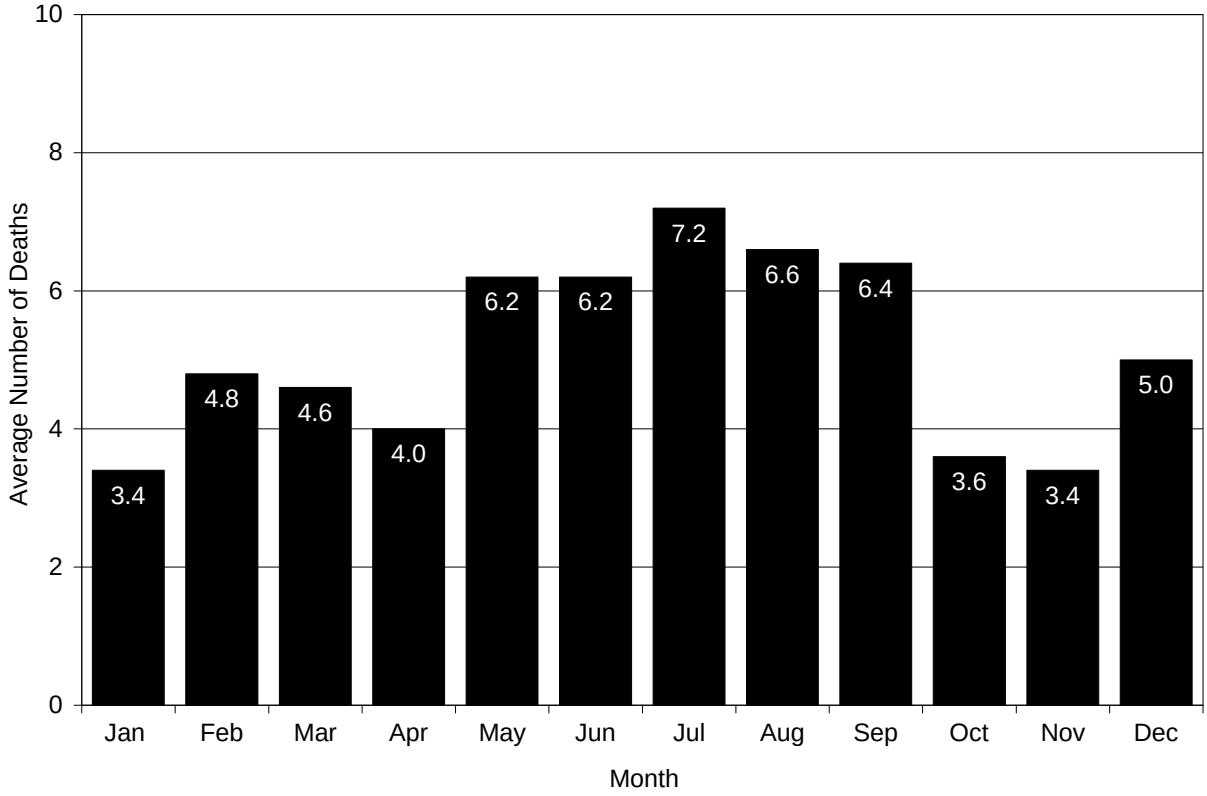
Source: National Mortality Collection; Numbers are per 5 year period.

Ethnic Trends
In New Zealand during 1996-2005, while SUDI rates declined for all ethnic groups, rates remained higher for (Prioritised) Māori > Pacific > European infants. During this period, SUDI rates were similar for Sole and Any Pacific infants (**Figure 16**).

Distribution by Age
In New Zealand during 2001-2005, SUDI rates were highest for infants 4-7 weeks of age, with rates then tapering off until 24-27 weeks, after which time they became relatively static. During this period, the largest number of deaths attributed to suffocation / strangulation in bed occurred prior to 20 weeks of age (**Figure 17**)

Distribution by Season
In New Zealand during 2001-2005, SUDI deaths were highest during the winter months (**Figure 18**). Small numbers however precluded a more detailed analysis by ethnicity.

Figure 18. Average Number of Deaths per Month due to Sudden Unexpected Death in Infancy, New Zealand 2001-2005



Source: National Mortality Collection;

Summary

Total Infant Mortality: In New Zealand during 1988-2005, total, neonatal and post-neonatal mortality all declined, with the most rapid declines occurring during the early-mid 1990s. Since 1998-99, total and neonatal mortality have become more static. During 1996-2005, total infant mortality was higher for Māori and Pacific > European > Asian infants. While post-neonatal mortality was higher for Māori > Pacific > European and Asian infants, neonatal mortality for Māori and Pacific infants was more similar (although rates for both groups were higher than for European and Asian infants).

Neonatal Mortality: During 2001-2005, the most frequent causes of neonatal mortality for both Sole and Any Pacific infants were extreme prematurity and congenital anomalies, although intrauterine / birth asphyxia also made a small contribution. During 1996-2005, neonatal mortality was higher for Sole than for Any Pacific infants, although large year to year fluctuations made precise interpretation of trends difficult.

Post Neonatal Mortality: During 2001-2005, the most frequent cause of post-neonatal mortality for both Any and Sole Pacific infants was SIDS, although a number of deaths were also attributed to suffocation / strangulation in bed and unspecified causes. Congenital anomalies also made a significant contribution. During 1996-2005, post-neonatal mortality was consistently higher for Sole than for Any Pacific infants.

Sudden Unexpected Death in Infancy (SUDI): In New Zealand during 1988-2005, SIDS rates declined, although increases in the number of babies dying from suffocation / strangulation in bed, or due to unspecified causes meant that declines in overall SUDI rates were not as marked as those for SIDS during this period. During 2001-2005, SUDI was *significantly higher* for Māori > Pacific > European and Asian infants and those in the more deprived areas. During 1996-2005, SUDI rates were similar for Sole and Any Pacific infants.

Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of SUDI

During the past two decades, a large number of risk factors for SUDI have been identified and a range of local research projects [92] and international reviews have considered interventions to reduce SUDI at the population level. In addition, the National Cot Death Campaign, based on four *modifiable* risk factors from the New Zealand Cot Death Study, resulted in a large decline in SUDI rates during the early 1990s [96]. As a consequence, there is now a reasonable evidence base regarding the types of interventions required to address SUDI at the population level. In the context of New Zealand's currently large ethnic and socioeconomic disparities in SUDI however, the most appropriate vehicles for implementation may require further consideration.

In addition, while in New Zealand at present, there is no single national strategy for the prevention of SUDI, the Child and Youth Mortality Review Committee recently released a position paper entitled *Preventing Sudden Unexpected Death in Infancy* [97], which outlines the most recent evidence in this area. In addition, **Table 16** summarises a range of other evidence based reviews which may be useful for those wishing to develop local strategies for SUDI prevention (Note: the publications listed were identified using the search methodology outlined in **Appendix 2** and as a consequence, should be viewed as providing an overview of the issues for which higher quality evidence (e.g. systematic reviews of multiple studies) was available, rather than as being indicative of the overall balance of interventions required in any local SUDI strategy).

Table 16. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Sudden Unexpected Death in Infancy (SUDI).

Ministry of Health Policy Documents
While no Ministry of Health policy documents focus specifically on SUDI, the **Child and Youth Mortality Review Committee** recently published a position paper entitled: **Preventing Sudden Unexpected Death in Infancy.** 2008, Ministry of Health; Wellington. http://www.cymrc.health.govt.nz/MOH.nsf/pagescm/6805/$File/sudi-infoforhealthpractitioners-2008.pdf. This position paper provides background information on SUDI, as well as advice to medical practitioners on the type of information they can give to parents and caregivers to reduce SUDI risk (e.g. smoking, bed-sharing, pacifier use).
In addition a range of Government policy documents and evidence based reviews consider population level approaches to known SUDI risk and protective factors. Two such factors are reviewed in other sections of this report: • Publications which relate to **Tobacco Control / Smoking** are reviewed in **Table 32** on **Page 120** • Publications which relate to **Breastfeeding** are considered in the In-Depth Review on **Page 58**
Systematic and Other Reviews from the International Literature
Hauck F, Omojokun O, Siadaty M. **Do Pacifiers Reduce the Risk of Sudden Infant Death Syndrome? A Meta-Analysis**. Pediatrics, 2005. 116(5):e716-23. Pacifiers have been associated with a reduced risk of SIDS, but many countries have been reluctant to recommend their use because of concerns about possible adverse effects. This meta-analysis evaluated the protective effects of pacifier use on SIDS and recommended that: pacifiers be offered to infants as a potential method to reduce SIDS risk; that pacifiers be offered to infants when being placed for all sleep episodes, including daytime naps and night time sleeps; that they be recommended for infants up to 1 year of age (which includes the peak age for SIDS risk). For breastfed infants, pacifiers should be introduced after breastfeeding has been well established.
American Academy of Pediatrics Policy Statement. **The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider In Reducing Risk**. Pediatrics, 2005. 116(5): 1245–1255. Since the AAP's last statement on SIDS in 2000, several issues have become relevant, including the significant risk of side sleeping position; the AAP thus no longer recognizes side sleeping as an alternative to fully supine sleeping and also stresses the need to avoid redundant soft bedding and objects in the infant's sleeping environment. In addition, the hazards of adults sleeping with an infant in the same bed are highlighted. The reduction in risk associated with having infants sleeping independently in the same room as adults was noted, as well as the use of pacifiers at the time of sleep. This statement reviews the evidence associated with these and other SIDS related issues and proposes new recommendations for further reducing SIDS risk.
Lumley J, Oliver S, Chamberlain C, Oakley L. **Interventions for Promoting Smoking Cessation During Pregnancy**. Cochrane Database of Systematic Reviews 2004, Issue 4. This review found that smoking cessation programmes in pregnancy reduced the proportion of women who continued to smoke, as well as the risk of low birth weight and preterm birth. The pooled trials however had inadequate power to detect reductions in perinatal mortality or very low birth weight.
Other Relevant Articles
Finau E, Finau S, Fuamatu N, Tukuitonga C. **SIDS or Sitisi: Plight and Response of Pacificans in New Zealand (Aotearoa).** Pacific Health Dialog, 2003. 10(2):182-92. This paper reports on Pacificans' experience with Sitisi (SIDS). The response includes research, community consultation, and training of culturally appropriate Community SIDS Educators. The importance of community-based strategies is central to the Pacificans' response to Sitisi and its determinants. The success of this approach provides a model for intervention and health promotion among Pacificans globally.
Tipene-Leach D, Able S, Haretuku R, Everard C. **The Māori SIDS Prevention Programme; Challenges and Implications for Māori Health Service Development**. 2000. Social Policy Journal of New Zealand.14: 65-77. This paper traces the development of the Māori SIDS programme describing the community consultation, appointment of regional co-ordinators, extension of the programme to the general population, the effect that structural reform had on the programme and issues related to the Treaty of Waitangi.

Tipene-Leach, D, Everard C, Haretuku R. **Taking a Strategic Approach to SIDS Prevention in Māori Communities- An Indigenous Perspective**, in SIDS Monograph, H. Kraus and R. Byard, Editors. 1999.

This chapter outlines aspects of the public health campaign to prevent SIDS in the Māori community. Why SIDS rates were so high amongst Māori infants is discussed, as well as the reasons why they remained high after the National Cot Death Campaign of 1991. The article outlines the strategic approach taken by the Māori SIDS Prevention Programme and examines some of the issues pivotal to the public health application of research findings to people in local communities.

In Depth Topic: Breastfeeding

Introduction

Breastfeeding was identified by DHBs as a priority area deserving of a more in depth review in their 2008 child health reports. Because achieving the Ministry of Health's exclusive / full breastfeeding targets of 74% at 6 weeks, 57% at three months and 27% at six months remains as much of a challenge for Pacific communities as for other ethnic groups, the in-depth review provided to DHBs has been reproduced in this report.

The review begins with a brief overview of the benefits of breastfeeding, before reflecting on the history of breastfeeding in New Zealand. International breastfeeding rates are examined and compared to rates in New Zealand. An analysis of the most recent available data from Plunket is then presented, followed by a brief review of the New Zealand literature, which explores factors that influence breastfeeding at an individual level. National strategies and legislation are then touched on, before a summary of reviews looking at the effectiveness of interventions to improve breastfeeding rates is presented. It is hoped that this summary will provide those working in the health sector with a starting point, when considering strategies for increasing breastfeeding rates amongst the Pacific communities in which they work.

Background: The Importance of Breastfeeding

It is widely accepted that breastfeeding has a range of advantages for both mother and child. These include health, nutrition, immunological, developmental, psychological, social and economic benefits [98]. The advantages for the infant include protection from infectious diseases such as bacterial meningitis, bacteraemia, diarrhoea, respiratory tract infections, necrotizing enterocolitis, otitis media, urinary tract infection and late onset sepsis in preterm infants [98],[99]. In the United States it has been demonstrated that infant mortality is also reduced by breastfeeding, with infant mortality rates being 21% lower for those infants that were breastfed, compared to those who were not [98]. While the evidence is not conclusive, studies have also suggested that breastfeeding is associated with a reduction in the incidence of SIDS, diabetes, some malignancies, obesity, hypercholesterolemia and asthma in older children and adults who were breastfeed compared to those who were not [98],[99].

The recognised benefits for mothers who breastfeed include decreased risk of breast cancer, decreased risk of ovarian cancer, decreased postpartum bleeding and possibly a decreased risk of hip fractures and osteoporosis in the postmenopausal period [98]. There are also benefits in terms of decreased health costs as well as environmental advantages of not producing infant formula [98].

For the reasons outlined above, breastfeeding is usually the optimal way to feed an infant. There are circumstances, however when breastfeeding is not in the best interest of the infant. The American Academy of Pediatrics Guidelines [98] state that breastfeeding is contraindicated if the mother has:

- Active, untreated TB
- T- cell lymphotropic virus type I or II positive
- Been receiving diagnostic or therapeutic radioactive isotopes
- Been exposed to radioactive materials
- Received antimetabolites or chemotherapeutic agents [100].
- Been using illicit drugs
- Herpes simplex lesions on her breast (they may be able to feed from the other breast if no lesions are present)

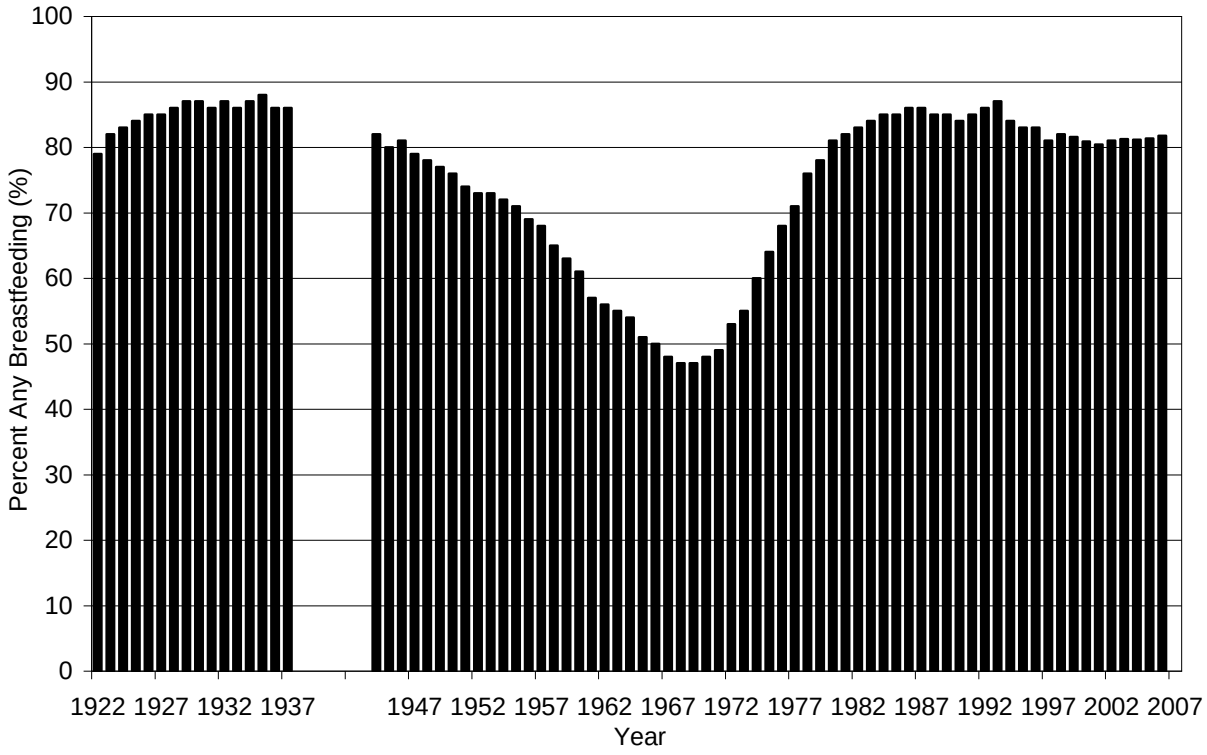
Breastfeeding guidelines for HIV positive women vary depending on the circumstances of the mother. Exclusive breastfeeding is recommended by WHO when no "culturally acceptable, feasible, affordable, safe and sustainable nutritional substitute for breast milk is available" [101]. In New Zealand this is not the case, and breastfeeding should be avoided in order to decrease the risk of vertical transmission of HIV from mother to infant. Another situation when

breastfeeding is contraindicated is when an infant has classic galactosaemia. Overall, most circumstances when breastfeeding is contraindicated are rare and need to be considered by the lead maternity carer on a case by case basis.

Breastfeeding in New Zealand during the Past Century

Despite the increasing evidence that breastfeeding is beneficial to both the mother and the infant, breastfeeding rates in some developed countries remain low compared to those of the early in the 20th century. Breastfeeding rates in New Zealand were high during the 1920s and 1930s but progressively decreased during the 1940s, 1950s and 1960's. Breastfeeding rates recovered during the 1970s and early 1980s, reached a plateau in the late 1990s, and have remained relatively static since (**Figure 19**).

Figure 19. Percentage of Babies Who Were Breastfed (Any Breastfeeding) at the Time of First Contact with Plunket, New Zealand 1922-2006



Source: Plunket Client Information Service

It is interesting to reflect briefly on what influenced the change in attitudes towards breastfeeding, as this may provide insights into how interventions could influence breastfeeding rates today. In Bryder's review "*Breastfeeding and Health Professionals in Britain, New Zealand and the United States, 1900-1970*" [102], she identifies a number of factors responsible for the changing attitudes towards breastfeeding. In New Zealand during the early 20th century, unlike in America, medical professionals recognised the importance of breastfeeding for protecting children against infectious diseases and doctors in New Zealand remained generally supportive of the practice of breastfeeding until the late 1940s.

After the Second World War, breastfeeding rates started to decrease in New Zealand for a number of reasons. At this time the views of medical professionals diverged. Doctors, such as Montgomery Spencer, who undertook his postgraduate training in America, advocated formula feeding as being scientifically superior to breastfeeding, while midwives and Plunket nurses continued to advocate strongly for breastfeeding. Bryder explored the reasons for these changing attitudes and identified two factors that may have influenced medical practitioners' enthusiasm for breastfeeding [102]. One of the factors Bryder proposed as contributing to this change in attitude by medical professionals was the outbreak of a penicillin resistant staphylococcal aureus, which was affecting women in maternity hospitals and causing breast

abscesses more often in women who were breastfeeding, compared to those who were not. The other factor postulated by Bryder as contributing to changing attitudes to breastfeeding was the rise of the lay natural child birthing movement, which emphasised natural childbirth. Many doctors disliked and mistrusted this new movement which also advocated strongly for breastfeeding [102].

There were also other changes in the way health care was delivered to infants and their mothers that may have influenced attitudes towards breastfeeding. Prior to 1938 Plunket nurses were responsible for supervising the majority of infant health care. However changes to the 1938 Social Security Act allowed for free antenatal checks, free delivery, free post natal checks and subsidised general practice visits [102]. This change in legislation resulted in mothers being more exposed to the views of doctors than they had been previously. Around this same time more women were choosing to deliver their babies in hospitals. Common practices of the day included separation of babies from their mothers and routine feeding rather than demand feeding [103]. Furthermore the major childrearing book consulted by women in the 1950s, written by American Dr Spock, was permissive of formula feeding and emphasised a more child centred approach to breast feeding, recommending demand breastfeeding [102]. Many women who were breastfeeding found demand feeding taxing and it was not an option for many mothers unless they had considerable support [102].

Bryder also attributes some of the decrease in breastfeeding rates to the medicalisation of breastfeeding by medical professionals. Ironically, by trying to enhance breastfeeding doctors encouraged the belief that breastfeeding was a "mechanistic process, liable to breakdown but which could medically controlled" [102]. This lead to the perception that breastfeeding was highly technical and that only a few women could perform it. It is interesting to note that some commentators argued that one of the main drivers of women giving up breastfeeding was the desire to return to work. However, the move away from breastfeeding in the post war era was not isolated to working mothers, and was not given as a reason for not breastfeeding by many mothers involved in studies on infant feeding at the time [102].

The increased exposure to doctors' attitudes to breastfeeding, as well as some practical barriers to the establishment of breastfeeding, may have lead to a change in the attitude of women at this time away from breastfeeding. During the 1970s, 1980s and 1990s breastfeeding initiation rates, as well duration of breastfeeding in New Zealand, increased. This is probably in part due to the women's movement which encouraged women to take responsibility for their own health, as well as recognition by the medical establishment that breast milk had significant benefits over formula for both mother and infant [102]. Bryder makes the point that while breastfeeding practices were driven by women of the time, attitudes and support of medical professionals appeared to play a key role in the success of breastfeeding [102].

Breastfeeding Definitions and Targets

The importance of breastfeeding is now recognised internationally as a way to improve infant health and decrease health outcome inequalities [100, 101, 104, 105]. The WHO has a number of definitions relating to breast feeding. These include [106]:

- *Breastfeeding*: The child has received breast milk (direct from the breast or expressed)
- *Exclusive Breastfeeding*: The infant has received only breast milk from his / her mother or a wet nurse, or expressed breast milk and no other liquids, or solids with the exception of drops or syrups consisting of vitamins, mineral supplements, or medicines
- *Predominant Breastfeeding*: The infant's predominant source of nourishment has been breast milk. However the infant may also have received water or water-based drinks (sweetened or flavoured water, teas, infusions, etc.); fruit juice; Oral Rehydration Salts (ORS); drop and syrup forms of vitamins, minerals, and medicines; and folk fluids (in limited quantities). With the exception of fruit juice and sugar-water, no food based fluid is allowed under this definition.
- Exclusive and Predominant Breastfeeding are considered to be *Fully Breastfeed*.

- *Complementary Feeding*: When a child receives breast milk and appropriate solid or semi solid food.

The definitions used in New Zealand to describe breastfeeding are similar to the WHO definitions and are as follows [105]:

- *Exclusive Breastfeeding*: The infant has never, to the mother's knowledge, had any water, formula or other liquid or solid food. Only breast milk, from the breast or expressed, and prescribed medicines have been given from birth.
- *Fully Breastfed*: The infant has taken breast milk only and no other liquids or solids except a minimal amount of water or prescribed medicines, in the past 48 hours.
- *Partially Breastfed*: The infant has had some breast milk and some infant formula or other solid food in the past 48 hours.
- *Artificially Fed*: The infant has had no breast milk but has had alternative liquid such as infant formula, with or without solid food in the past 48 hours.

The WHO recognises the crucial role that appropriate feeding practices play in achieving optimal health and recommends that whenever possible infants should be fed exclusively on breast milk from birth until six months of age (breast milk only, with no water, other fluids or solids) with supplemental breastfeeding then continuing for 2 years and beyond [101]. Many countries, including the UK, USA, and New Zealand, have developed targets reflecting the WHO guidelines. In 2002, the Ministry of Health recommended the following targets for breastfeeding in New Zealand[105];

1. To increase the breastfeeding rates (exclusive and fully) at 6 weeks to 74% by 2005, and 90% by 2010.
2. To increase the breastfeeding rates (exclusive and fully) at 3 months to 57% by 2005 and 70% by 2010
3. To increase breastfeeding rates (exclusive and fully) at 6 months to 21% by 2005 and 27% by 2010.

More recently, breastfeeding was identified by the Ministry of Health as a priority in their *'Improving Nutrition, Increasing Physical Activity and Decreasing Obesity'* target [79]. The stated target reflects a combination of the 2005 and 2010 targets outlined above, with the aim being for 74% of infants to be exclusively and fully breastfed at 6 weeks, 57% at three months and 27% at six months [79].

International Breastfeeding Rates

Both the initiation of breastfeeding and the duration of breastfeeding are commonly reported when comparing breastfeeding rates between countries. Comparing studies of breastfeeding rates can be difficult. This is because different studies may include a sample that is not representative of the population, different definitions of breastfeeding may be used between surveys, or breastfeeding rates may change relatively quickly making it difficult to compare older data from one country with more recent data for another [107].This said, on the basis of the information available, New Zealand's breastfeeding rates compare favourably to America and the UK, but less favourably to some Nordic countries.

Regional surveys from Sweden in 1999 indicate that 98% of women initiate breastfeeding and 75-86% of mothers are still exclusively breastfeeding at 2 months. At six months 23 -52% of women are still exclusively breastfeeding [108]. Norway also has high breastfeeding rates with a national survey reporting 98% of women exclusively breastfed at 3 months, with 40% of women continuing to breastfed to some extent at 12-15 months [108].

Preliminary data from the United States' Centres for Disease Control National Immunisation survey 2005, found that 31.5 % infants were exclusively breastfeed at three months, while 11.9% of infants were exclusively breastfeed at six months [109]. While rates of exclusive breastfeeding have increased in the US since 1999, they remain below the target for exclusive breastfeeding of 40% and 17%, at 3 and 6 months respectively. The survey also found that 23 US states achieved National Healthy People 2010 objective of 75% of mothers initiating

breastfeeding. Only 8 states reached the objective of 17% of mothers exclusively breastfeeding their infant through to 6 months of age. This survey also found that 25% of breastfed infants are supplemented with infant formula within 2 days of birth [109].

The proportion of babies who are breastfed has been steadily increasing in the United Kingdom since 1990 with 76% of women initially breastfeeding their infant in 2005, compared to 69% of mothers in 2000 [110]. The 2005 Infant Feeding Survey showed that 65% of women were exclusively feeding at birth, 45% at 1 week, 21% at 6 weeks and only 3% of women were exclusively breastfeeding at 5 months [110]. There was some variation by country with 77% of women living in England and Wales initiating breastfeeding compared to 70% in Scotland and 63% in Northern Ireland. By six weeks postpartum 48% of UK women were still breastfeeding and by 6 months 25% of women were still breastfeeding their infant [110].

A National Health survey was undertaken in Australia in 2001 and found that 87% of infants aged 0-3 years had been breastfed at some stage [111]. In 2001, nearly half (48%) of all children were being breastfed at 6 months. By 1 year of age 23% of children were being breastfed and 1% of children were being breastfed at age 2 years.

New Zealand's Current Breastfeeding Rates: Survey Data

The latest New Zealand Health Survey 2006/2007 asked specifically about breastfeeding, weaning and the introduction of solids [112]. This survey interviewed the parent or caregiver of 4921 children (including 1983 Māori, 798 Pacific, 742 Asian, and 3039 European/Other children). The survey found that 87.8% of children aged from birth -14 years had ever been breastfed with the mean length of breastfeeding being 8 ½ months. The survey found that 72.9% of children <5 years of age were exclusively breastfed at six weeks of age. This declined to 55.8% at 3 months and 7.6% at 6 months. Pacific and Māori children were less likely to have ever been breastfed, compared to the total child population rate, adjusted for age. However at 6 weeks and 3 months there were no differences by ethnic group in the proportion of children exclusively breastfeed. At 6 months, European children were less likely to be exclusively breastfed than all children. Infants living in areas of low deprivation (NZDep quintile 1) were more likely to be exclusively breastfeed than infants living in more deprived areas (NZDep quintile 5). While being a representative sample, these findings are limited by the wide range of ages included (i.e. 0-14 years and 0-5 years), and the size of the sample surveyed.

Breastfeeding Rates in New Zealand

Plunket Data

Plunket have, for a number of years, collected information on breastfeeding rates from the children under their care. The following section briefly explores breastfeeding rates in New Zealand using Plunket data.

Data Source and Methods

Definition

Exclusive / Full Breastfeeding Rates at <6 weeks, 3 months and 5 months

Data Source

Exclusive / Full Breastfeeding Rates at <6 weeks, 3 months and 5 months

Numerator: Plunket Client Information System: The proportion of babies who were exclusively / fully breastfed at <6 wks (2 wks - 5 wks, 6 days), 3 months (10 wks - 15 wks, 6 days) and at 6 months (16 wks - 7 months, 4 wks).
Denominator: Plunket Client Information System: The number of babies in contact with Plunket at these ages

Notes on Interpretation

Plunket currently enrol more than 88% of the new baby population, although Māori and Pacific mothers may be under-reported in these samples. Plunket have breastfeeding data dating back to 1922, with more detailed information being available in recent years.

Indicator Category

Proxy C

New Zealand Distribution and Trends

Trends by Age: During 1999-2003, the proportion of babies who were exclusively / fully breastfed at 3 and 6 months increased. While between 2003 and 2008 the proportion of babies who were exclusively / fully breastfed at 6 months continued to increase, the proportion who were exclusively / fully breastfed at <6 weeks and 3 months declined slightly (**Figure 20**).

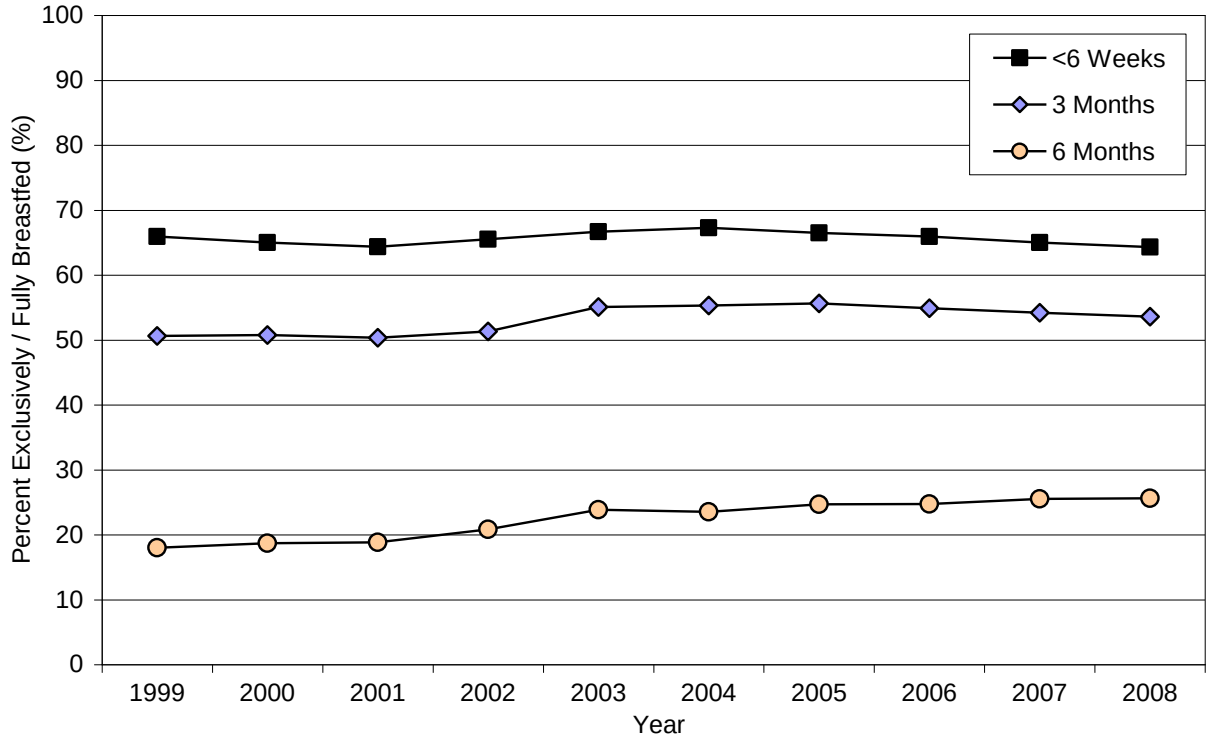
Ethnic Differences: During 2004-2008, breastfeeding rates for Pacific women were consistently lower than for European women at <6 weeks, 3 months and 6 months, although differences between Pacific women and Māori and Asian women were less consistent. During 2008, Pacific women's breastfeeding rates of 53.3% at <6 weeks, 42.6% at 3 months and 17.9% at 6 months came in below the Ministry of Health's targets of 74% at 6 weeks, 57% at three months and 27% at six months of age (**Figure 21**).

Socioeconomic Differences: In the year ending June 2006, there were marked socioeconomic gradients in the proportion of babies exclusively or fully breastfed, with rates at all three ages being higher for babies living in Decile 1-4 (the most affluent) > Decile 5-7 > Decile 8-9 > Decile 10 (the most deprived) areas (**Figure 23**).

Summary

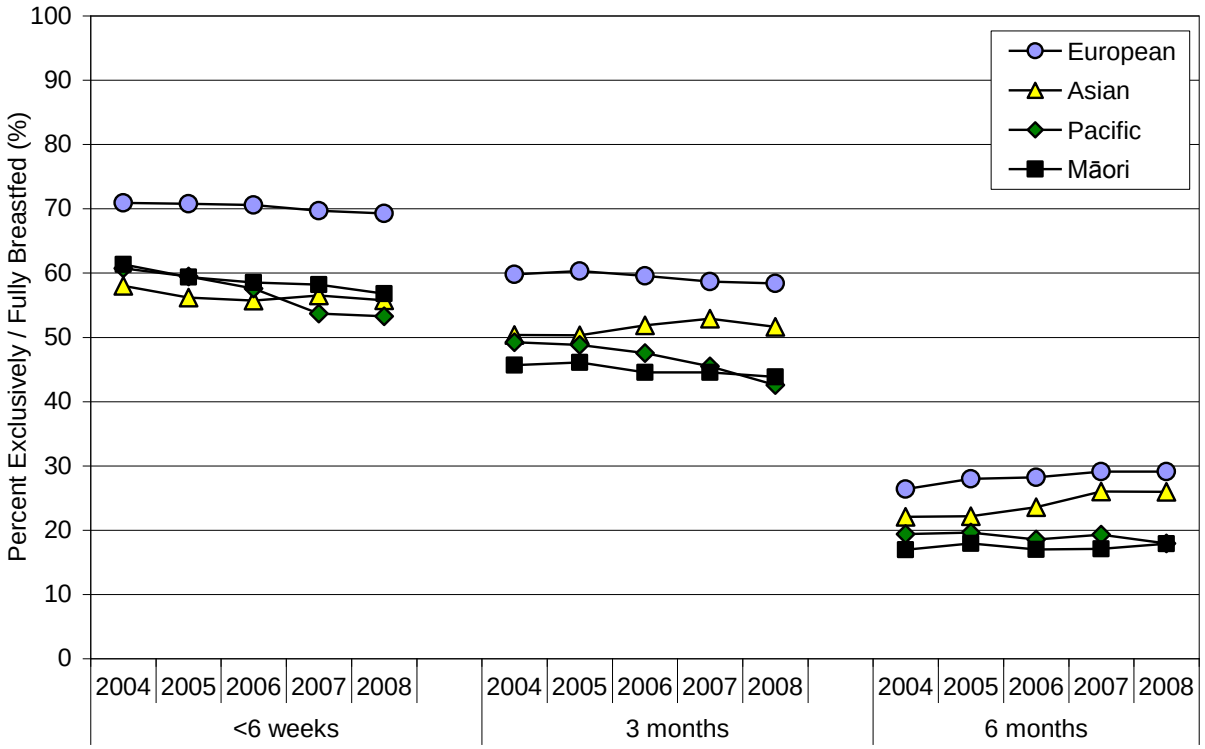
In New Zealand during 2004-2008, breastfeeding rates for Pacific women were consistently lower than for European women at <6 weeks, 3 months and 6 months, although differences between Pacific women and Māori and Asian women were less consistent. During 2008, Pacific women's breastfeeding rates of 53.3% at <6 weeks, 42.6% at 3 months and 17.9% at 6 months came in below the Ministry of Health's targets at each of these age groups.

Figure 20. Percentage of Plunket Babies who were Exclusively or Fully Breastfed by Age, New Zealand 1999-2008



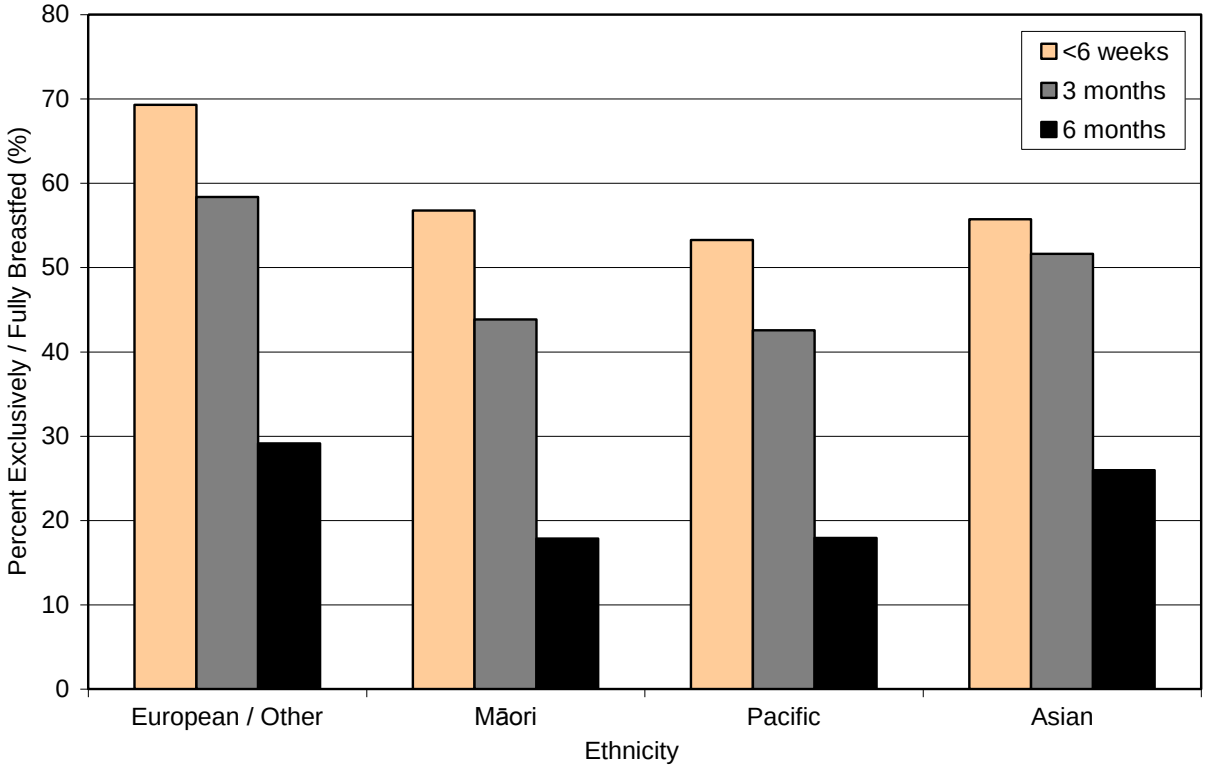
Source: Plunket Client Information Service

Figure 21. Percentage of Plunket Babies Who Were Exclusively or Fully Breastfed by Age and Ethnicity, New Zealand 2004-2008



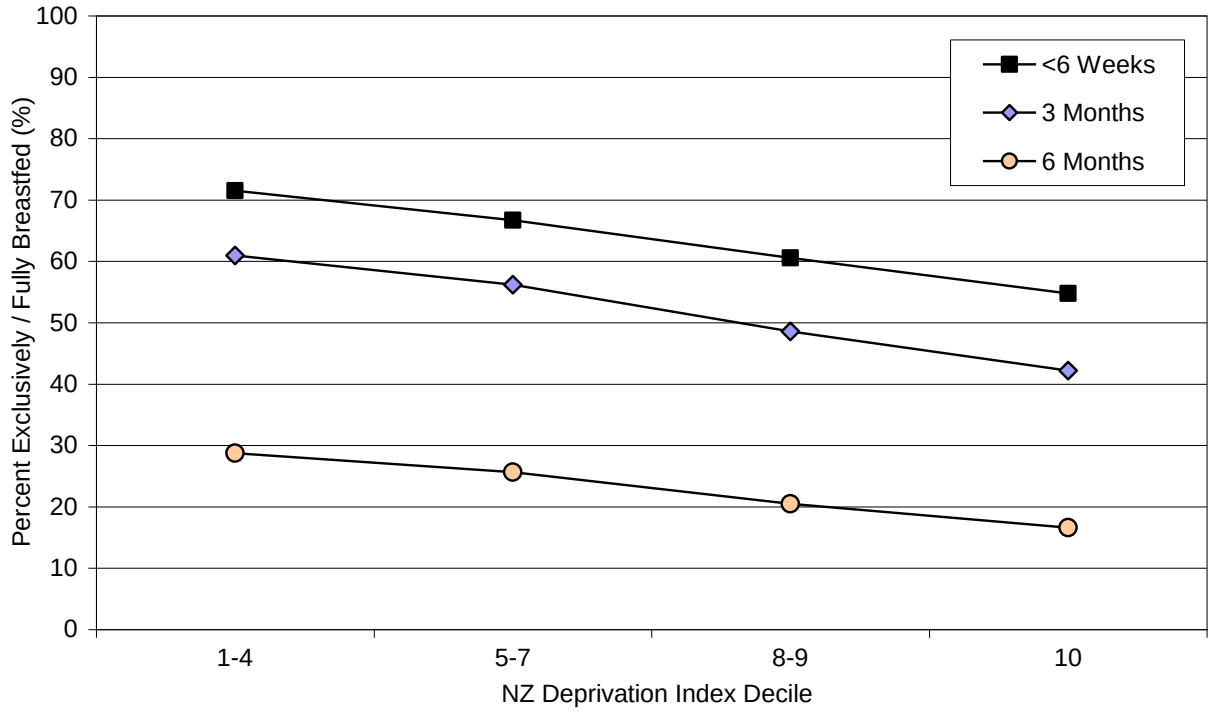
Source: Plunket Client Information Service

Figure 22. Percentage of Plunket Babies Who Were Exclusively or Fully Breastfed by Age and Ethnicity, New Zealand 2008



Source: Plunket Client Information Service

Figure 23. Percentage of Plunket Babies who were Exclusively or Fully Breastfed by Age and NZ Deprivation Index Decile, New Zealand year ending June 2006



Source: Plunket Client Information Service

Factors Influencing Breastfeeding

In all countries breastfeeding initiation rates are closely related to social class, income and educational levels [113]. In the UK it is recognised that better educated mothers who do not smoke, have higher socio economic status and are older are more likely to breastfeed than other mothers [99]. Mothers who have previously breastfed or who were breastfed themselves are also more likely to breastfeed [99]. White mothers in the UK are less likely to initiate breastfeeding, and those that do breastfeed do so for a shorter time, than women from other ethnic groups [114].

Individual Level Factors Influencing Breastfeeding: UK, USA and Australia

In the UK women who have a general anaesthetic for a caesarean section have been found to be less likely to breastfeed than women who have a normal delivery, or women who have a caesarean section with an epidural [114]. Women who go back to work when the baby is between six weeks and four months have also been found to have the shortest duration of breastfeeding in the UK [114]. The most common reason given by mothers for stopping breastfeeding in the 2005 UK feeding survey was insufficient milk (39%) followed by baby rejected the breast (20%), painful breasts /nipples (14%) or took too long to feed (14%)

In contrast to the UK, American white mothers have the highest breastfeeding rates, with black women having much lower breastfeeding rates than whites, Hispanic, Latino, Asian/Pacific or American Indian mothers [115]. While employed women have almost identical breastfeeding initiation rates as women who stay at home (66.6 % and 64.8% respectively), at six months there are more marked differences with 26% of women who work full time breastfeeding compared with 35% of stay at home mothers [115]. A national survey in America found that 18% of women reported that their job schedule was the reason for discontinuing breastfeeding [116].

The National Health Survey (2001) in Australia found the most common reason for discontinuing breastfeeding in children aged 0-3 was insufficient milk supply (30%)[111], with an estimated 40% of women who ceased feeding in the first year of life citing insufficient milk supply as a reason for not continuing with breastfeeding. Only 8% of mothers cited returning to work as a reason for stopping breastfeeding in the 0-3 year age group. Australian women

who are older and better educated were found to be more likely to breastfeed for longer compared to other mothers [111].

Individual Level Factors Influencing Breastfeeding: New Zealand

A longitudinal study was undertaken of 4286 infants in New Zealand (1990-1991) to assess the prevalence rates of breastfeeding and identify why women stopped breastfeeding [117]. The most common reason for stopping breastfeeding was perceived inadequate supply of breast milk. The exception to this was Pacific Island mothers, whose main reason for stopping breastfeeding between six weeks and three months post partum was returning to work or study (38% of mothers who stopped breastfeeding)[117].

Qualitative research undertaken by Vogel et al in the mid 1990s in New Zealand identified that many mothers found breastfeeding difficult and many had negative experiences in the hospital setting [118]. Common concerns raised by women and healthcare workers in focus groups were the workload for staff, the lack of knowledge about breastfeeding by healthcare workers as well as the lack of consistency between staff. It was suggested by some participants that early discharge from hospital may minimise negative experiences for mothers but concern was also raised about the amount of practical support available for women in the community to support breastfeeding. The authors suggest a number of changes they believe need to occur in order to improve the initial breastfeeding experiences of mothers while they were in hospital. These included ensuring adequate staffing levels on the post natal wards; continuity of staff; staff education; appropriate accommodation for mothers and adequate quality of food for breastfeeding mothers [118].

Further qualitative work by Vogel et al [119] looked specifically at the influences that mothers and health care workers perceived as being important for determining the duration of breastfeeding. The attitudes of mothers and healthcare workers to expressing breast milk and other forms of feeding in the New Zealand context were also explored [119]. Both mothers and health care workers thought breastfeeding took time and commitment. Women's plans about duration of breastfeeding were often influenced by past experiences and other commitments such as returning to work and the demands of other children. Participants in the study felt that prolonged breastfeeding was not well accepted in the community, particularly among men. Both mothers and healthcare workers were concerned about difficulties in getting an older child to take a bottle if it is not introduced early. There was agreement that frequent postnatal visits by one person were necessary to support breastfeeding mothers. Mothers described feeling a large amount of pressure to breastfeed. Some healthcare workers were concerned that demand feeding was taken to the extreme and caused problems [119].

The authors of this study suggest that community acceptance of breastfeeding is important and in order to encourage this breastfeeding needs to be seen as a societal norm through such measures as including appropriate pictures in children's books, allowing appropriate modelling in play and the provision of breastfeeding facilities in public places [119]. The authors also advocated for increased emphasis on breastfeeding education in antenatal class, increased recognition of the value of parenthood, improved maternity leave provision, flexibility for part time work and improved facilities for expressing and/or breastfeeding in workplaces [119]. Concern was also raised about the influence of advertising commercial follow-on formulas and the advertising of breast pumps more widely. Developing hospital environments that are supportive of breastfeeding mothers and their infants was also identified as being important in improving breastfeeding rates in New Zealand.

Following on from this qualitative research, a cohort study was designed to look specifically at the factors identified in previous research that may influence the duration of breastfeeding [120]. The study included 350 mother-infant dyads in Auckland who were predominately white and middle class. 97.4% of mothers initiated breastfeeding with 75% of mothers still breastfeeding at 3 months while 44% were still fully breastfeeding at this time. The most common reasons given for cessation of breastfeeding were insufficient milk (19.1%), mother wanted to stop (16.8%), and baby refused (15.3%).

This study found that young maternal age, use of a dummy in the first month, not sharing a room with mother and not sharing a bed with mother were associated with shorter duration of

breastfeeding [120]. Tertiary education and higher socioeconomic status showed a trend towards increasing duration of breastfeeding but did not reach significance. Being married was not associated with longer duration of breastfeeding, nor was being a non smoker (although small numbers of smokers were included in the study). Mother's who returned to work within the first year breastfed for a shorter time but this did not reach significance in the multivariate model. The use of formula in the first month of life was associated with a shorter duration of breastfeeding. The study also found an association between self reported mastitis and longer duration of breastfeeding [120].

Other New Zealand studies also found an association between the use of pacifiers and shorter duration of breastfeeding [121, 122]. The association between dummy use and shorter duration of breastfeeding may not be causal and more research is needed to explore this association.

McLeod et al undertook a prospective study to examine the influences of women's experiences in preparing for and establishing breastfeeding on the subsequent duration of breastfeeding[123]. 1,047 women were eligible for the study and of these 665 women responded to the initial questionnaire (68.4%). There were 7% Māori women in the original cohort but no other ethnicity information about the women was given. When asked at 20-24 weeks gestation, 490 (74%) women stated they intended to breastfeed. The study found that tertiary education, higher socioeconomic status and non smoking were associated with longer duration of breastfeeding. Just prior to delivery, 31% of women planning to breastfeed felt they needed more information about breastfeeding and these women were more likely to feed for a shorter time compared to those women who didn't feel like they needed more information. Insufficient milk or unsettled, hungry babies were the most common reasons given for stopping breastfeeding. An association between returning to work and stopping breastfeeding was also seen in this study. A number of women who were no longer breastfeeding at 4 months stated they would have liked to have breastfed for longer. The authors suggest that breastfeeding rates could be improved by having more information provided about breastfeeding prior to delivery, the provision of more advice and support for breastfeeding mothers, as well as implementing specific strategies for employed mothers to help support ongoing breast feeding [123].

Individual Level Factors Influencing Breastfeeding: Pacific Mothers in NZ

Factors associated with not breastfeeding exclusively among mothers of a cohort of Pacific infants in New Zealand were investigated specifically [122] as part of the Pacific Islands Families Study. Analyses were undertaken to identify factors that were associated with breastfeeding at discharge and also factors that were associated with breastfeeding at 6 weeks. Based on hospital discharge data, 81.6% of mothers of Pacific infants were exclusively breastfeeding their infant at the time of discharge from hospital. A number of factors were significantly associated with not exclusively breastfeeding at discharge. These included caesarean section, not being employed prior to pregnancy, residency >10 years in New Zealand, multiple birth status, not seeing a midwife during pregnancy, and smoking.

Of the 1,017 mothers who initially breastfed exclusively at discharge, 62% continued to do so at 6 weeks[122]. Factors associated with increased risk of cessation of exclusive breastfeeding at six weeks were different, with the exception of cigarette smoking, from those factors associated with not exclusively breastfeeding at discharge. These factors included higher parity, infant not discharged home at the same time as mother, having a home visit from a traditional healer, not receiving a home visit from the Plunket nurse, regular childcare arrangements, dummy use, and the infant not sharing the same room as the parents at night.

A further study, also undertaken as part of the Pacific Island Families study, examined breastfeeding rates and practices among Pacific women at 6 weeks, 12 months and 24 months [124]. This study estimated exclusive breastfeeding rates were 84% at hospital discharge, 49% at 3 months, 37% at 3 months and 9% at 6 months for pacific infants. None of the mothers reported exclusive breastfeeding at 12 months or 24 months. At the 6 weeks interview, 16% of infants had not been visited at home by a Plunket nurse but no statistical difference was found in exclusive breastfeeding rates for those that had and had not been visited by a Plunket nurse. The most common reasons given for introducing complementary

liquid foods (more than one response could be given) included uncertainty about adequate milk supply from breastfeeding (56%), problems with breasts (cracked nipples, infections) (30%) and difficulties with breast-feeding due to return to work or study (26%). Many mothers (50%) with these concerns did not seek advice about these issues.

The study also found a persistent difference between Pacific groups, with Tongan mothers having lower breastfeeding rates than Samoan mothers [124] thus emphasising the importance of monitoring breastfeeding rates for Pacific Island ethnic groups separately. This study also found that maternal smoking, return to employment, low birth weight and separate hospital discharge were associated with early cessation of exclusive breastfeeding [124].

A qualitative study was undertaken looking at infant care practices in New Zealand and compared the attitudes to breastfeeding between different ethnic groups [75]. The study included Māori, Tongan, Samoan, Cook Island, Niuean and Pakeha caregivers living in Auckland. There was agreement between all ethnic groups that breastfeeding was important because of the physical and emotional benefits for both them and their baby [75]. It was also recognised that breastfeeding was convenient and cheap by all ethnic groups. There was also agreement between all ethnic groups that breastfeeding was not easy and could be painful because of cracked nipples, and breast engorgement. This physical discomfort of breastfeeding, combined with the perception of not having enough milk and conflicting advice from medical professionals (and in some cases relatives), were the reasons given for stopping breastfeeding or starting complementary feeding. The introduction of complementary formula feeds was common amongst all ethnic groups. This was initiated by mothers because of the perception they were not providing enough milk for their baby. Most noted that their babies were more settled and slept for longer once they were started on complementary feeds.

Different ethnic groups had different ideas about when the most appropriate time to introduce food was. While some health professionals advise the introduction of solids at 4 months of age (and WHO recommends 6 months [101]) several Māori , Pacific and young Pakeha women stated they introduced solids at 3 months. Some Pacific caregivers stated they began their baby on solids as early as 6-8 weeks because the baby remained unsettled after feeding. It was also noted in this study that most Pacific mothers did not attend antenatal classes or seek postnatal support from professional organisations. Instead they obtained information and support from family members. Some perceived that such organisations were aimed at Pakeha mothers and were not relevant to them [75].

Individual Level Factors Influencing Breastfeeding: Māori Mothers

The factors that influence breastfeeding in Māori women have been studied recently in a qualitative study of 30 mothers [125]. Five factors were identified that were felt to influence Māori mother's breastfeeding rates which included; interruption to a breastfeeding culture; difficulty establishing breastfeeding within the first six weeks; poor or insufficient professional support; perception of inadequate milk supply; and returning to work [125]. Most of the women believed that breastfeeding was the tika or 'right' way to feed infants and recognised the health benefits of breastfeeding. The majority (27) of women in this study breastfed their infants. The women acknowledged that breastfeeding was easier than bottle feeding, more convenient and free. A small number of women did not breastfeed their infants because of problems such as inverted nipples. Many women described difficulties with breastfeeding particularly with breast engorgement and a third of women suffered from cracked nipples. Most of the women in this study did not attend antenatal care and left hospital shortly after birth. A number of women complained about the lack of consistency of breastfeeding advice with different midwives providing different and, at times, conflicting information. A number of women commented that they had to stop breastfeeding when they returned to work.

From the available literature a number of conclusions can be drawn. Women appear to know that breastfeeding is best for their baby and the majority of pregnant women intend to breastfed their infants. Initiation rates of breastfeeding in New Zealand are comparatively high compared to other countries. Women perceive a strong breastfeeding culture in which bottle feeding is perceived to be less acceptable. The most common reason for cessation of breastfeeding and/or the introduction of complement feeding is related to perceived inadequacy of milk supply. Lack of education about breastfeeding prior to delivery and

subsequent lack of support to maintain breastfeeding in the face of difficulties such as cracked nipples and pain have been shown to be factors influencing the duration of breastfeeding. The literature suggests that creating environments supportive of breastfeeding in hospital, public facilities and the workplace may help enhance the duration of breastfeeding.

National Factors Influencing Breastfeeding in New Zealand

Legislation is one tool that can be used to support and promote breastfeeding. Internationally legislative measures have been used to support women's ability to breastfeed while working and also support a woman's right to breastfeed in a public place [126].There is no legislation in New Zealand that specifically protects a mother's right to breastfeed or indeed an infant's right to be breastfed [126]. There are however a number of pieces of legislation that are relevant to breastfeeding. These include:

- The Human Rights Act 1993
- The Parental Leave and Employment Protection Act 1987 (amendment 2002)
- Corrections Regulations 2005

The details of this legislation are not included in this report as DHBs have a limited role in influencing such legislation. However a detailed description of the legislation, as it pertains to breastfeeding, can be found in "Protecting, Promoting and Supporting Breastfeeding in New Zealand" [126] .This document also provides a critical appraisal of international models for specific legislation that has been used to in order to protect and promote breastfeeding in other countries.

Later in this report a number of interventions are reviewed that have been shown to influence the initiation and duration of breastfeeding. The focus is intentionally on programmes that can be instigated by DHBs in order to promote and support breastfeeding in their communities. However, it is important to view breastfeeding practices in a social and cultural context and acknowledge the range of factors that contribute to a mother's decision to breastfeed. The National Institute for Health and Clinical Excellence (NICE) has developed the following table as an example of how multiple factors influence infant feeding at international, national, regional and individual levels (**Table 17**). While this example was developed for the UK context it is still useful to consider how these different factors interact in the New Zealand context and influence breastfeeding rates.

New Zealand's Current Strategies and Action Plans

The New Zealand government has recently formed the National Advisory Committee to provide advice to the Minister and to develop a new *National Strategic Plan of Action for Breastfeeding 2008-2012* [127]. This Strategic plan is still in draft form but identifies a number of priority areas for action, based on a recent review of the literature [126]. The health service and family/community priorities in this plan [127] have relevance to DHBs and include:

- Improving access to antenatal education (particularly for high need groups)
- Establishing peer support services for breastfeeding mothers
- Increasing community support for breastfeeding
- DHBs becoming Baby Friendly Hospital organisations
- Reviewing the implications of workforce shortages on breastfeeding women and rates
- Increasing the capacity of Māori and Pacific workforces to provide family/ whanau support

Until this new strategy is endorsed, *Breastfeeding: A Guide to Action*, published in 2002 remains the current governmental strategy document [105]. This action plan identifies seven goals, each with a number of associated action points. Many of these goals are similar to the priority areas identified in the new strategy and aim to:

- Establish a national intersectoral breastfeeding committee
- Achieve Baby Friendly Hospitals throughout New Zealand

- Gain active participation of Māori and Pacific whanau/family to improve breastfeeding promotion, advocacy and support
- Establish nationally consistent breastfeeding reporting and statistics
- Increase breastfeeding promotion, advocacy and co-ordination at national and local levels
- Ensure pregnant women can access antenatal care
- Ensure high quality and ongoing postpartum care

One of the action points underpinning the goal of increasing breastfeeding promotion was to complete a review of the WHO's *International Code of Marketing Breast-milk Substitutes* [128]. This review was undertaken [129] and *Implementing and Monitoring the International Code of Breast-milk Substitutes in New Zealand*: *The Code in New Zealand*, was subsequently released in 2007 [130]. This document outlines New Zealand's policy position in relation to the marketing of breast milk substitutes. (NZ has 4 codes that implement different aspects of the international code, 3 of which are voluntary and self regulating (Code of Practice for Health Workers, Code of Practice for the Marketing of Formula, Code of Advertising of Food and Food Standards Code) while one (Australia NZ Food Standards Code) is not voluntary.

Other national policies that are relevant to breastfeeding promotion include:

- The New Zealand Health Strategy
- Healthy Eating Healthy Action
- Māori Health Strategy- He Korowai Oranga
- Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women

The details of these strategies can be found on the government website http://www.MOH.govt.nz.

There are also a number of international conventions and strategies that provide guidance to governments about how to best support and promote breastfeeding. These include:

- The International Code of Marketing of Breast Milk Substitutes [128]
- Maternity Protection Convention (ILO Convention No 183) [131]
- Innocenti Declaration on the Protection, Promotion and Support of Breastfeeding [132]
- UN Convention on the Elimination of all forms of discrimination against Women[133]
- The Global Strategy for infant and Young Child Feeding (WHO/UNICEF 2003)[101]
- United Nations Convention on the Rights of the Child [134]
- The Ottawa Charter for Health Promotion [135]

It is beyond of the scope of this review to detail these documents. There is however a succinct summary of these documents, and their relevance in the New Zealand context, provided in *Protecting, Promoting and Supporting Breastfeeding in New Zealand* [126].

Table 17. Examples of Factors Which Influence Feeding at International, National, Regional and Individual Levels

International and National Factors	National and Regional Factors	Individual Factors: Amenable to Medium → Long Term Change at Macro Socio-Economic Level	Individual Factors Influencing Decision to Breastfeed: Amenable to Short Term Change at Micro Socio-Economic Level	Individual Factors Influencing a Woman's Decision to Stop Breastfeeding Before She Wishes: Amenable to Change in Short Term at Micro Level
Globalisation of formula feeding in developed countries promulgated by commercial interests	Lack of importance / understanding of breastfeeding in the organisation of health services; embedded practices or routines which interfere with breastfeeding	Maternal age: younger mothers are less likely to breastfeed	Attitudes of partner, mother and peer group.	Mother's or health professionals' or family's perception of 'insufficient milk'
Cultural shift to regimented feeding patterns and growth monitoring based on formula feeding regimes.	Lack of appropriate education and training for health and related professionals.	Maternal education: breastfeeding rates are lowest among those who left school at 16 or less.	Social support provided by woman's partner, family and friends	Painful breasts and nipples
Increase in work opportunities for women without supportive childcare / feeding facilities	Lack of integration across Sectors: acute, community, social services, voluntary	Socio-economic status of mother (and partner): breastfeeding rates become lower for lower socioeconomic groups	Loss of collective knowledge and experience of breastfeeding in the community resulting in a lack of confidence in breastfeeding	Baby would not suck or 'rejected the breast'
Media portrayal of bottle feeding as the norm and as safe	Lack of supportive environments outside the home and in the workplace	Marital status	Whether mothers were breastfed themselves as babies	Breastfeeding takes too long, or is tiring
Increased media portrayal of women's breasts as symbols of sexuality	Lack of breastfeeding education in schools	Ethnicity – cultural tendency for white women to choose not to breastfeed	Embarrassment about, difficulty in, or perceived unacceptability of, breastfeeding in public, both in and outside the home, especially for younger mothers	Mother or baby is ill
Lack of full implementation of WHO Code on Marketing of Breast Milk Substitutes		Biomedical factors (parity, method of delivery, infant health). Return to work before the baby is 4 months old.	Difficulty of involving others, especially partner, in feeding. Perceived inconvenience of breastfeeding and anxiety about total dependence of baby on the mother.	Difficult to judge how much baby has drunk. Baby can't be fed by others

Source: Promotion of breastfeeding initiation and duration: Evidence into Practice. July 2006[136].

The Effectiveness of Interventions to Influence the Initiation and Duration of Breastfeeding

Interventions that aim to increase breastfeeding rates can be divided into those interventions which help promote the initiation of breastfeeding and those which influence the duration of breastfeeding. While research has been undertaken in New Zealand to identify factors that influence breastfeeding rates, no intervention studies were found in the literature that evaluate the efficacy or otherwise of interventions aimed to increase breastfeeding rates in New Zealand. Therefore in order to consider how breastfeeding rates can be improved, evidence from the international literature will be presented in this section.

The National Institute of Clinical Excellence (NICE) has undertaken a significant body of work reviewing the evidence for both facilitating the initiation and duration of breastfeeding and have synthesised this information into *Promotion of Breastfeeding Initiation and Duration. Evidence into Practice Briefing* [136]. Similarly the NICE antenatal and post natal care guidelines provide a comprehensive review of the literature relating to breastfeeding [137].

The National Breastfeeding Advisory Committee has also commissioned a review of the literature in order to inform the development of *National Strategic Plan of Action for Breastfeeding* [126, 127]. Most of the literature included in the review is published after 2002 although some exceptions were made when documents were considered still relevant e.g. WHO documents. This is a comprehensive review which incorporates the New Zealand local policy context. Evidence from these reviews and others are summarised below. It should be noted that there is some overlap with the same studies included in a number of reviews.

Health Education Programmes

Health education interventions can take a number of different forms. They all, however, provide factual information or technical advice about breastfeeding to a group of woman and/or health professionals in a specific setting [138]. It is generally agreed that the provision of information about, and support of, breastfeeding is an important determinant of breastfeeding success [136, 139].The most effective timing and format by which such education is delivered has been the subject of research.

Guise et al undertook a systematic review of primary care based interventions that aimed promote breastfeeding [140]. Twelve randomised controlled trials (RCTs) were included in the review which investigated the impact of individual or group education sessions on breastfeeding. Most of these interventions were delivered antenatally by nurses or lactation specialists. A meta-analysis showed that education interventions significantly increased the initiation and short term duration of breastfeeding (up to three months). It was found that the format of the education sessions (group versus individual) did not influence the success of the programme.

The results of this review differ from a recent Cochrane review which looked at the effect of antenatal education on a number of variables including breastfeeding [141]. Nine trials, involving 2,284 women, were included in the review but no data were reported about breastfeeding success. The authors concluded that the effect of antenatal education on childbirth, parenthood or both remain largely unknown.

There is some evidence from studies involving low income black women in the United States that suggests that one on one educational programmes may also be useful in increasing the initiation of breastfeeding in those women who planned to bottle feed, while group education sessions were better for those who planned to breastfed [113]. There is evidence that group health education interventions are effective in increasing breastfeeding initiation among women from low income groups, across a number of ethnicities [113, 142]. Renfrew et al also concluded in their review that group, interactive, culture specific education sessions increased the duration of breastfeeding [107].

Evidence also suggests that the length of the education course (whether it be individual or group sessions) is an important variable that influences the success of such programmes, with one off lessons being less successful in prolonging the duration of breastfeeding than longer

courses [126, 136]. The Canadian Task Force on Preventative Health Care (CTFPHC) recommends the use of education programmes (and postpartum support) to promote breastfeeding including the provision of structured antepartum breastfeeding education programmes and in person or telephone support [143]. Paying participants to attend education sessions has been found to improve participation [113].

There is also evidence that the provision of written materials does not increase the initiation or duration of breastfeeding. Protheroe et al [113] included two reviews [138, 144] in their review of public health interventions to increase breastfeeding and found that distributing breastfeeding literature alone is not effective at increasing the initiation of breast feeding in women [113]. Renfrew et al included a study in their review that found the provision of a self help manual alone did not increase breastfeeding duration [107]. Similarly written education materials provided during postnatal care in the community were not shown to be helpful in increasing the duration of breastfeeding [107]. Guise et al concluded that written materials alone did not increase breastfeeding rates [140].This review also found that the effectiveness of written materials plus education was the same or less effective as education alone. The CTFPHC and the US Preventative Task Force also reviewed the evidence in regards to the provision of written materials to new mothers to promote breastfeeding and determined that there was good evidence to recommend against this practice [143].

A recent New Zealand review of the literature commissioned by the Breastfeeding Advisory Committee concluded that there was little evidence to support the use of written materials in order to increase the duration of breastfeeding [126]. However this review did include a recent study by Ingram and Johnson [145] that suggests written materials may be useful in increasing the duration of breastfeeding, when used to complement verbal discussion.

Health Education Programmes: Key Points

Provision of group or individual interactive education sessions have been shown to increase the initiation of breastfeeding

Antenatal education probably increases breastfeeding initiation and short term duration of breastfeeding

The length of the education course influences breastfeeding outcomes

Written materials alone have not been shown to be effective at increasing initiation or duration of breastfeeding

Breastfeeding Support Programmes

A number of reviews have considered the effectiveness of different types of breastfeeding support programmes. Fairbank et al identified one RCT that investigated the impact of social support from health professionals on breastfeeding initiation rates [138]. In this study the effect of support, in the form of a telephone call or a home visit from a midwife, on the initiation of breastfeeding among socially disadvantaged women was examined. While women in the intervention group were positive about the role of the midwife, no significant differences were reported in the initiation of breastfeeding between the control and the intervention group.

Guise et al identified 8 RCTs that investigated the effectiveness of breastfeeding support programmes that involved in-person or telephone support by lactation consultants, nurse or peer counsellors [140]. Interventions included occurred at different times with some occurring exclusively in the antepartum period (3), some occurred exclusively in the postpartum period (3) and some interventions occurred in both the ante and postpartum period (2). It was found that support significantly increased duration of breastfeeding but did not affect breastfeeding initiation rates. The authors also examined four RCTs that combined education programmes with breastfeeding support interventions and found that such programmes lead to higher initiation rates but no difference in long term duration of breastfeeding.

de Oliveira et al [142] also undertook a systematic review looking at the evidence for extending breastfeeding duration through primary care interventions. They found that interventions which were long term and intensive; and combined face to face information, guidance and support, were the most effective in increasing the duration of breastfeeding.

Interventions which included the prenatal or prenatal and postnatal periods were more successful that those that occurred in the postnatal period only [142].

A Cochrane review was undertaken to look at the effectiveness of providing support to breastfeeding mothers [146]. The authors identified 34 trials including 29,385 mother-infant pairs. The authors included studies where the intervention included a post natal intervention or an antenatal and postnatal intervention. Interventions that only included an antenatal intervention were excluded as were interventions that only involved education alone. All forms of extra support (additional lay or professional support) analysed together showed a significant increase in any breastfeeding up to six months. Support was also shown to be important for the continuation of exclusive breastfeeding with women who receive any support being less likely to stop exclusive breastfeeding before 5 months [146]. Overall professional support, lay support and combinations of these did not differ significantly in their effectiveness of influencing any breastfeeding. However it was found that lay support lead to a significant and marked reduction in cessation of exclusive breastfeeding within the first three months. The authors also found that face-to face support was more useful than those interventions based on telephone support.

Fairbank et al identified two RCTs that investigated the effect of peer support on the initiation of breastfeeding in women in low income groups [138]. Both of these studies showed that peer support could increase both initiation and duration of breastfeeding for women who wanted to breastfeed. The US Department of Agriculture runs programmes for women, infants and children. Five of these programmes were found to be effective at increasing breastfeeding initiation and three of these programmes included peer support programmes [138].

Guise et al also looked at the effectiveness of peer support in their review [140] .One RCT and 4 non-RCTs were included. The authors judged that there was insufficient evidence to evaluate the effectiveness of such studies because of the poor quality of the trials. The CTFPHC recommends that interventions which utilise peer counsellors are effective at increasing the initiation and duration of breastfeeding [143]. Protheroe et al also concluded that antenatal education sessions are more effective when there was contact with peer counsellors [113].

There is little evidence that a single home visit by a nurse following early discharged or a GP clinic visit one week postpartum has any influence on breastfeeding rates [107]. However, the review commissioned by the National Breastfeeding Advisory Committee reviewed seven recent studies that investigated the effectiveness of home visiting as a means of delivering breastfeeding support [126] and found strong evidence to support this delivery model especially in regards to re-establishing exclusive breastfeeding. They found that telephone support needs to be combined with face-to-face support if it is to be effective. Although the review only cited one study [147] that investigated the use of the internet for providing mother to mother support, the authors suggest this approach shows ‘promise’ [126].

Multifaceted interventions, that combine antenatal education with proactive postnatal support both in the hospital and the community, appear to increase the duration of breastfeeding [107]. Likewise antenatal education combined with partner support as well as post natal support and incentives for women in low income groups also has been showed to increase the duration of breastfeeding [107].

Fairbank et al included one non-RCT and ten before and after studies in their review of multifaceted interventions [138]. Overall multifaceted intervention programmes were found to be effective at increasing the initiation rates of breastfeeding as well as the duration and exclusivity of breastfeeding. The interventions which were found to be most effective included a media campaign and/or a peer support programme combined with a health education programme, training of health professionals and/ or changes in hospital policy or occasional health education activities [138].

As discussed previously Scandinavia has high breastfeeding initiation rates [108]. Four interventions have been implemented in this region over the last 20 years and are thought to have contributed to these high initiation rates [113]. These interventions include;

- The provision of problem based information about breastfeeding.
- Widespread availability of peer support groups for mothers.
- Increased paid maternity leave with guaranteed return to previous employment.
- Supportive hospital environments for mothers and infants.

Breastfeeding Support Programmes: Key points

Professional or peer support can increase duration of breastfeeding
Multifaceted interventions can increase the initiation, duration, and exclusivity of breastfeeding

Health Sector Initiatives

Health sector initiatives refer to changes that enhance the care provided to women so that breastfeeding is promoted and supported [113]. One of the most significant health sector initiatives adopted in many countries, including New Zealand, is the Baby Friendly Hospital Initiative (BFHI). This programme was launched by WHO and the United Nations Children's Fund in 1991 and promotes the "Ten Steps to Successful Breastfeeding" which support and promote breastfeeding in the hospital setting. The WHO has recently reviewed the evidence for the 'Ten Steps' and found that that implementation in maternity facilities can increase breastfeeding in almost any setting [148]. While implementing each step by itself has some effect, implementation of all ten steps is expected to have the greatest impact [148]. The effect of the Baby Friendly Hospital was evaluated in Scotland and it was found that breastfeeding rates have increased significantly faster in hospitals with Baby Friendly status [137].

Fairbank et al reviewed the effectiveness of interventions to promote the initiation of breastfeeding and found that institutional changes in hospital practices to promote breastfeeding either as part of, or independent of, the Baby Friendly Initiative can be effective at both increasing the initiation and duration of breastfeeding [138]. Protheroe et al found that training staff, employment of a breastfeeding counsellor, the provision of written information and rooming in combined were effective at increasing both the initiation and duration of breastfeeding [113].

The review undertaken on behalf of the Breastfeeding Advisory Committee cited a review by Della et al [149] that found breastfeeding outcomes were significantly improved when women delivered in Baby Friendly accredited hospitals or hospitals where a number of the ten steps have been implemented.

Ten Steps to Successful Breastfeeding

Have a written breastfeeding policy that is routinely communicated to all health care staff.

Train all health care staff in the skills necessary to implement this policy.

Inform all pregnant women about the benefits and management of breastfeeding.

Help mothers initiate breastfeeding within one half-hour of birth.

Show mothers how to breastfeed and maintain lactation, even if they should be separated from their infants.

Give newborn infants no food or drink other than breast milk, unless medically indicated.

Practice rooming in - that is, allow mothers and infants to remain together 24 hours a day.

Encourage breastfeeding on demand.

Give no artificial teats or pacifiers to breastfeeding infants.

Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.

A recent Cochrane review looked at the effects of early skin to skin contact on breastfeeding and infant breastfeeding behaviour [150]. While the quality of the 17 studies included in this review was poor and there was marked variation in the intervention characteristics, the authors concluded that early skin to skin contact appeared to have some benefit regarding breastfeeding outcomes with no apparent short term or long term negative effects [151]. A study by Komara et al [152], cited in a recent review [126], also supports early skin to skin contact to improve initiation rates of breastfeeding. Also cited in the same review [126] is a study by Zarei et al [153], which found that in-service education for nurses combined with a protocol encouraging early initiation of feeding within an hour of birth and skin to skin contact increased early initiation rates of breastfeeding.

Dyson et al found no studies that evaluated specifically the timing of the first feed but did find evidence to suggest that earlier feeding may have some advantages including strengthening the mother baby bond and maintenance of the baby's temperature [136]. The EU project on Promotion of breastfeeding in Europe [139] cited a Cochrane review (now out of date and thus withdrawn), that reportedly found no difference between early initiation of breastfeeding and breastfeeding at 4-6 hours after birth. The WHO-UNICEF 'Ten Steps to Successful Breastfeeding' recommends initiating breastfeeding within one half-hour of birth [105].Recent evidence has indicated that restrictive feeding practices may be detrimental to breastfeeding [136] and WHO recommends that breastfeeding should be unrestricted and be supported whenever the baby shows signs of hunger or when the mother wishes to feed.

Protheroe et al cited a Brazilian study that showed that rooming in was effective for increasing the initiation and duration of breastfeeding [113]. Guise et al only identified one study, conducted in a developed country, which undertook rooming in as an intervention to increase breastfeeding rates [140]. However this was one of many interventions and the effectiveness of rooming alone could not be ascertained. Renfrew et al identified evidence that unrestricted feeding from birth with unrestricted mother-baby contact from birth with the avoidance of supplementary fluids for babies, unless medically indicated, were all effective in increasing the duration of breastfeeding [107]. Although the evidence is not conclusive, it is generally accepted that mothers and babies should not be separated following birth unless there is an unavoidable medical reason for it [137]. CTFPHC recommends rooming in and early maternal contact to promote breastfeeding [143].

Brown et al undertook a review which considers the effects of early postnatal discharge for healthy women and term babies[154]. This review of trials compared the policy of early discharge after childbirth with standard length of stay and care at the time. Reports of problems with breastfeeding and conflicting advice on breastfeeding in the first four weeks after birth were included as secondary outcomes [137]. The results of six trials showed that early discharge had no impact on breastfeeding, although significant heterogeneity was present between studies [154]. Dyson et al suggest in their review that early discharge may limit women's exposure to detrimental hospital practices [136].

The provision of formula in discharge packages to new mothers was found to be associated with lower breastfeeding rates [107, 143] and it is now widely accepted that this practice should be avoided.

Health Sector Initiatives: Key Points

Implementation of the Baby Friendly Hospital Initiative leads to increased initiation and duration of breastfeeding

Early skin to skin contact may improve breastfeeding outcomes

Mothers should not be separated from their infant unless medically indicated

Early discharge does not appear to influence breastfeeding rates

Discharge packs should not contain commercial infant formula

Training Health Professionals

Breastfeeding education is one of the 'Ten Steps to Successful Breastfeeding' which is promoted through the Baby Friendly Hospital Initiative [148]. Studies have suggested that

health professionals have insufficient training prior to clinical work to effectively support breastfeeding [139]. Several studies have been undertaken to evaluate the effectiveness of in-service training. A systematic review undertaken by Fairbank et al identified five before and after studies which looked at the effect of training health professionals on the initiation of breastfeeding [138] and found that while such programmes may be useful at increasing the knowledge of midwives and nursing stuff, no significance difference was shown in terms of breastfeeding rates [138]. However the EU Project on Promoting Breast feeding in Europe reviewed the evidence in relation to the effectiveness of the UNICEF/WHO training course (and training courses based on these) at improving breastfeeding management and concluded such courses were effective and recommended the use of in-service training as a way of increasing breastfeeding rates [139].

Renfrew et al included 9 of studies in their review of the impact of health professional and lay breastfeeding educator/counsellor training, education and practice change on the duration of breastfeeding [107] and found there was no single way to consistently change professional practice to support breastfeeding and increase breastfeeding duration. However, they acknowledge that UNICEF training was shown to be effective and recommend UNICEF training should be undertaken in UK [107]. Prothroe et al found that training of health professionals as part of a health sector initiative lead to significant improvement in women's attitude and knowledge of breastfeeding. While they found limited evidence that training health professionals increased breastfeeding initiation rates, they suggest a package of interventions including training may be more likely to improve initiation rates.

The recent literature review undertaken in New Zealand found that training health professionals is important as it enabled health professionals to provide consistent and clear advice to mothers which in turn was critical for supporting breastfeeding [126]. Like Renfrew et al, the authors of this review acknowledge the limited evidence currently available to determine the most effective means of delivering this training, but also conclude that WHO/UNICEF training courses appear to be effective based on the available evidence.

Training Health Professionals: Key Points

Staff should receive in-service training to ensure that consistent messages are provided to mothers

WHO/UNICEF training courses have been shown to be effective at up skilling staff

Community Support

Community based interventions aiming to increase the initiation and duration of breastfeeding can include a range of programmes e.g. workplace programmes, breastfeeding education in schools, mass media campaigns and programmes which support breastfeeding in public[107, 136].

The EU project reviewed two systematic reviews and found that television campaigns (not newspaper campaigns) could improve attitudes towards breastfeeding which resulted in higher initiation rates [139]. The evidence reviewed suggested that national media campaigns only had a positive effect on women with higher incomes whereas media campaigns that were developed locally increased breastfeeding initiation rates among women of all incomes. World breastfeeding week has been celebrated in many countries since 1992. There is, however, no published evaluation on the impact of such weeks [139]. Renfrew et al did not identify any studies in their review which examined the effect of mass media campaigns on breastfeeding outcomes [107]. They note that there is, however, a large amount of research about attitudes to, and beliefs about breastfeeding that can be utilised when designing media campaigns.

Evidence presented in the previous section showed that returning to work is associated with stopping breastfeeding [115, 117, 125]. While interventions to support women to breastfeed in the workplace would seem likely to increase rates of breastfeeding, little research has been undertaken to investigate this. Renfrew et al cite one study by Cohen et al [155] which describes two corporate lactation programmes in the US [107]. While the study found that 65% of mothers who returned to work while breastfeeding continued to do so until at least six months, the quality of the study was poor and only 24-49% of eligible women participated in

the programme. Renfrew et al suggest that further research is needed into effective workplace interventions to increase the duration of breastfeeding and suggest that RCTS evaluating the effectiveness of on-site nurseries, rooms and flexible breaks and the availability of breast pumps would be useful[107].

The literature review commission by the National Breastfeeding Advisory Committee cites a study by Ferreira-Rea et al which found that women who had breastfeeding facilities on site were more likely to breastfeed for longer than women who did not have access to such facilities [126]. This review also found evidence that providing education and practical support for expressing breast milk lead to longer duration of exclusive breastfeeding [126].

A Cochrane review was recently undertaken to evaluate the evidence for workplace interventions that promote breastfeeding [156]. No evidence was found from RCTs or quasi-randomised trials that evaluated workplace interventions in promoting breastfeeding in women returning to paid work [156]. There are also no studies assessing the role of flexible working conditions, such as flexible working hours or the ability to work from home, on the duration of breastfeeding [126].

While there is good evidence that father's and partner's attitudes towards breastfeeding influences initiation and duration of breastfeeding [139], there is little evidence about interventions targeted specifically at fathers and partners. Renfrew et al [107] included a study in their review by Cohen et al [157] which described a corporate lactation programme which promoted breastfeeding by targeting male employees. Of the 331 eligible men, 128 participated in the programme with their partner. The programme offered the options of two group education sessions about breastfeeding or one individual session focused on breastfeeding including information about expressing. The programmes resulted in breastfeeding rates well above the national average.

Community Support: Key Points

TV campaigns can improve attitudes towards breastfeeding and increase initiation rates
More research is needed into how best to support mothers who are returning to work to continue to breastfeed
More research is needed to determine the most effective ways to increase community support for breastfeeding e.g. through school interventions or programmes for fathers

Other Interventions

As noted in the previous section cracked nipples and pain were often associated with breastfeeding. There is some evidence that prevention and treatment of sore nipples should focus on correct positioning and attachment [107]. Cabbage leaves/extract may help the management of engorged breasts and systemic antibiotics probably help infected nipples and thus enhance the duration of breastfeeding [107].

Renfrew at al found a number of practices were identified as being ineffective or detrimental for breastfeeding [107]. These included:

- Conditioning nipples in pregnancy
- Hoffman's exercises for inverted and non-protractile nipples in pregnancy
- Breast shells for inverted and non-protractile nipples in pregnancy
- Topical agents for the prevention of nipple pain
- Breast pumping before the establishment of breastfeeding in women at risk of delayed lactation

Other Interventions: Key Points

Instruction on correct positioning and attachment will help prevent of pain, cracked nipples.
Appropriate clinical treatment of mastitis and cracked nipples is important for increasing the duration of breastfeeding
Inappropriate interventions should be avoided

Conclusion

Exclusive breastfeeding provides the most appropriate nutrition for most infants in the first six months of life. The New Zealand government has identified breastfeeding as an important determinant of health and has set targets for breastfeeding rates. In order to reach these targets a number of changes need to occur. Breastfeeding needs to be considered a societal norm with family and community support. Mothers need to be aware of the advantages of breastfeeding and be supported to breastfeed their children particularly if they are returning to paid employment. A number of interventions have been shown to increase the initiation and duration of breastfeeding as described above. There is certainly the opportunity for DHBs to initiate programmes that have been shown to increase the initiation and duration of breastfeeding in the literature. There are, however, a number of gaps in the literature and innovative interventions undertaken to improve breastfeeding rates should be carefully evaluated in order to add to the knowledge base about what works in this area.

Å Gastro-Oesophageal Reflux

Introduction

Gastro-oesophageal reflux (GOR) is one of the commonest gastrointestinal problems seen in infants presenting to primary care [158], with symptoms including recurrent regurgitation, irritability, excessive crying, food refusal, feeding difficulties, abnormal posturing and failure to thrive [159]. It has been estimated that approximately 50% of infants <2 months have symptoms of reflux, (defined as >2 episodes per day of regurgitation or emesis), with the figure increasing to 70% by 4 months. By 12 months however, the prevalence of symptoms usually falls to 1-5%, with the greatest declines occurring between 6 and 8 months of age [158].

While the aetiology of GOR is multi-factorial, the primary causative mechanism is inappropriate relaxation of the lower oesophageal sphincter which allows gastric acid to reflux back into the oesophagus. While most of these reflux episodes are brief, asymptomatic and limited to the lower oesophagus, more severe reflux (including very frequent reflux, or where clearance of the lower oesophagus is poor) [159], can overwhelm mucosal barriers, resulting in oesophagitis, with its attendant complications including blood loss, scarring and stricture formation [158].

In most cases a thorough history and clinical examination will be sufficient to diagnose GOR and to initiate appropriate treatment, although a range of investigations (e.g. endoscopy, oesophageal pH monitoring) are available for the small number of cases where the diagnosis remains uncertain, or where complications are suspected [158]. In terms of management, treatment modalities can be considered in one of three groups: lifestyle, pharmacological and surgical. Lifestyle changes include thickening feeds and paying attention to infant positioning, while pharmacological interventions include medications which reduce gastric acid secretion, or enhance gastrointestinal motility. Surgical management is generally restricted to infants with life threatening GOR, or with reflux arising from congenital malformations [159].

In New Zealand, while there is very little information on the prevalence of gastro-oesophageal reflux amongst Pacific infants, gastro-oesophageal reflux is considered an ambulatory sensitive condition, on the basis that appropriate lifestyle and pharmacological interventions may prevent a significant proportion of hospital admissions in this age group. The following section thus explores hospital admissions for gastro-oesophageal reflux amongst Pacific infants in New Zealand using information from the National Minimum Dataset. Policy and evidence based review documents which consider how gastro-oesophageal reflux might be addressed at the population level, are considered at the end of this section.

Data Sources and Methods

Definition

Hospital Admissions for Gastro-Oesophageal Reflux in Infants < 1 Year

Data Sources

Numerator: National Minimum Dataset: Hospital admissions in infants <1 year with a primary diagnosis of Gastro-Oesophageal Reflux (ICD-10 K21).
Denominator: Birth Registration Dataset

Notes on Interpretation

Note 1: *Appendix 4: The National Minimum Dataset* outlines the limitations of the data used. The reader is urged to review the contents of this appendix before interpreting any trends based on hospital admission data.
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category

Proxy B

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1996-2007, hospital admissions for gastro-oesophageal reflux in infants initially increased, reached a peak in 2000-01 and thereafter declined (**Figure 24**).

New Zealand Distribution by Age

In New Zealand during 2003-2007, hospital admissions for gastro-oesophageal peaked at 4-7 weeks of age, with numbers then tapering off progressively until 28-31 weeks, after which time they became relatively static (**Figure 25**).

Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

In New Zealand during 2003-2007, hospital admissions for gastro-oesophageal reflux were *significantly lower* for Pacific infants than for European infants. Rates however were *significantly higher* for males and those living in urban or very affluent (NZDep Decile 1) areas (when compared to those in very deprived (NZDep Decile 10) areas) (**Table 18**).

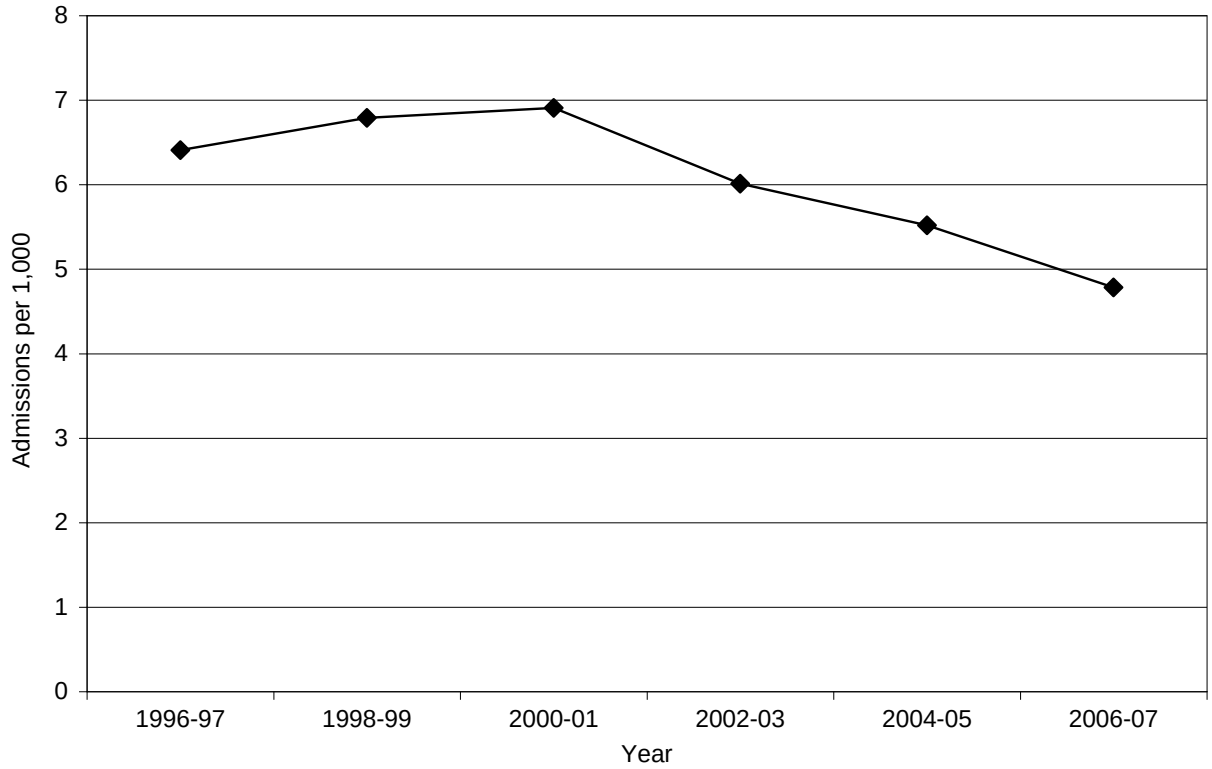
Ethnic Specific Trends

In New Zealand during 1996-2007, gastro-oesophageal reflux admissions were consistently lower for Pacific, Māori and Asian infants than for European infants (**Figure 26**).

New Zealand Distribution by Season

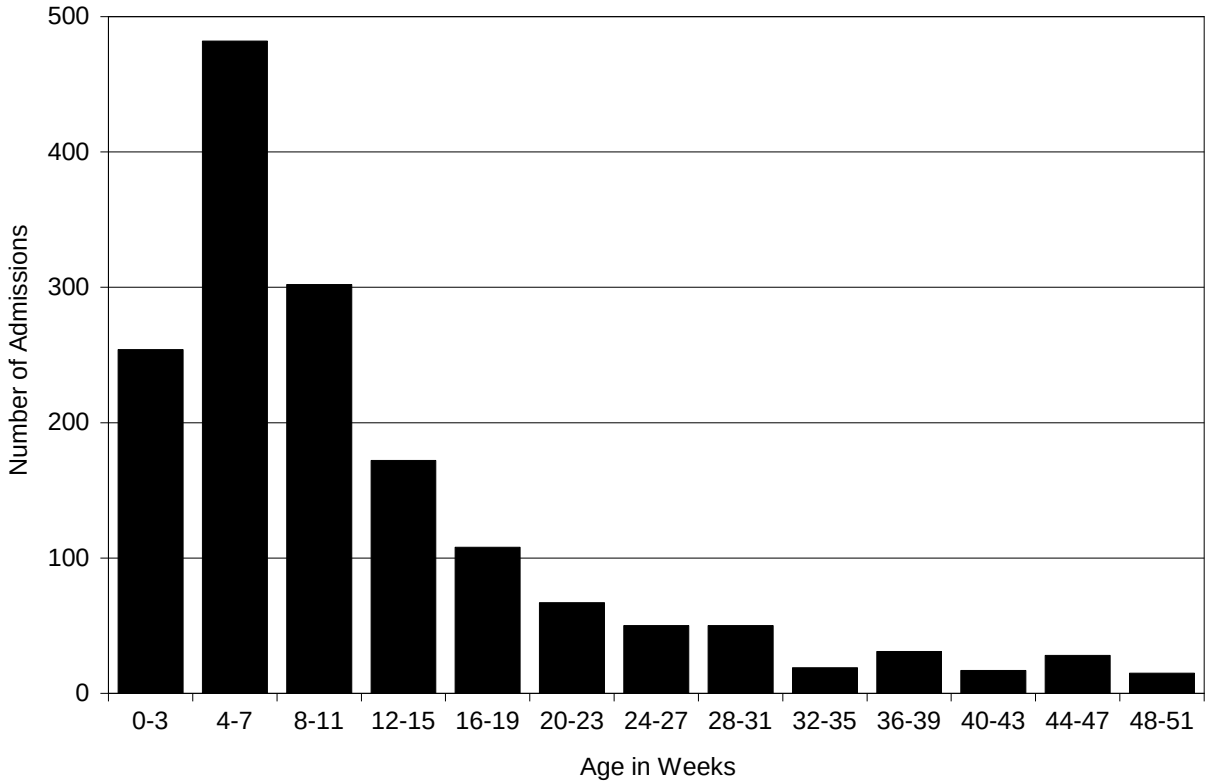
In New Zealand during 2003-2007, there were no marked seasonal variations in hospital admissions for gastro-oesophageal reflux. Small numbers precluded a more detailed ethnic specific analysis, and thus seasonal patterns for Pacific infants need to be estimated from national figures (**Figure 27**)

Figure 24 Hospital Admissions for Gastro-Oesophageal Reflux in Infants < 1 Year, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset.

Figure 25. Hospital Admissions for Gastro-Oesophageal Reflux in Infants <1 Year by Weeks of Age, New Zealand 2003-2007



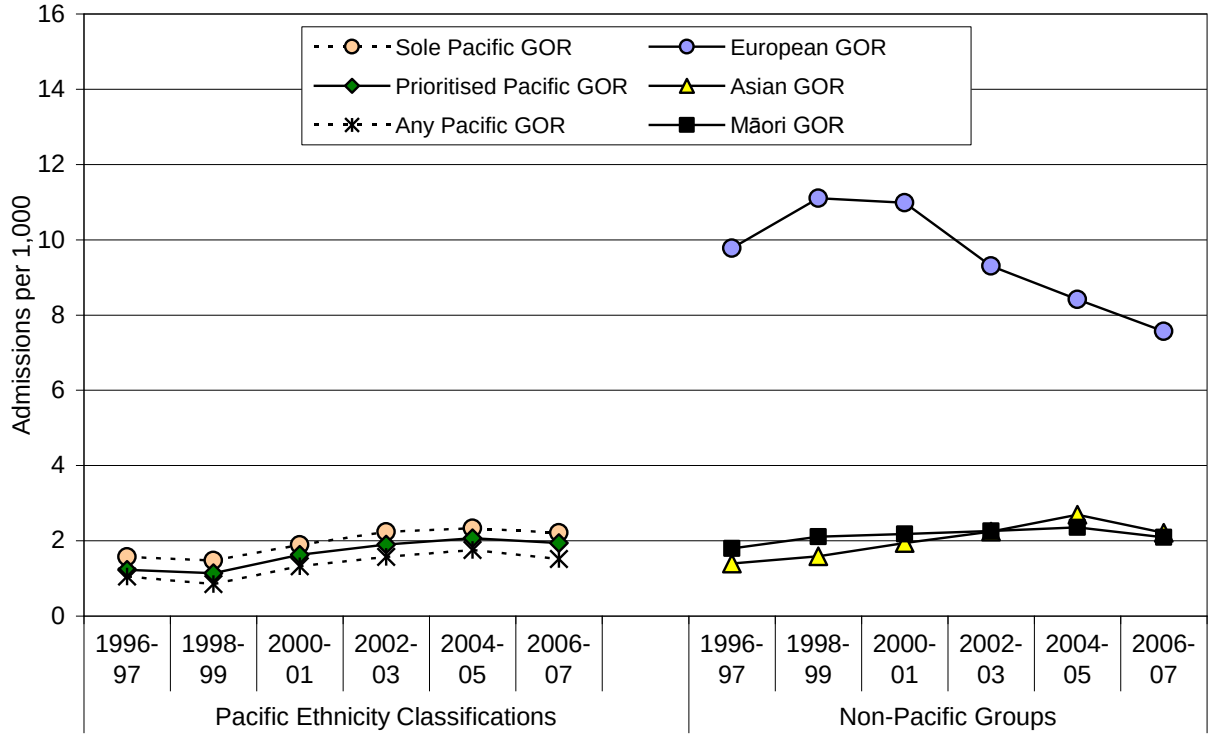
Source: National Minimum Dataset; Numbers are per 5 year period.

Table 18. Risk Factors for Hospital Admissions due to Gastro-Oesophageal Reflux in Infants <1 Year, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	5.79	1.00		1-2	5.27	1.00	
2	4.79	0.83	0.64 - 1.06	3-4	6.33	1.20	1.02 - 1.42
3	6.00	1.04	0.82 - 1.31	5-6	6.40	1.21	1.03 - 1.43
4	6.61	1.14	0.91 - 1.43	7-8	5.46	1.04	0.88 - 1.22
5	6.26	1.08	0.86 - 1.36	9-10	3.99	0.76	0.64 - 0.89
6	6.51	1.13	0.90 - 1.40	Prioritised Ethnicity			
7	5.52	0.95	0.76 - 1.20	European	8.25	1.00	
	5.40	0.93	0.75 - 1.16	Māori	2.27	0.27	0.24 - 0.32
9	5.02	0.87	0.69 - 1.09	Pacific	2.08	0.25	0.20 - 0.32
10	3.08	0.53	0.42 - 0.68	Asian	2.45	0.30	0.23 - 0.38
Gender				Urban / Rural			
Female	5.04	1.00		Urban	5.61	1.00	
Male	5.60	1.11	1.01 - 1.23	Rural	3.46	0.62	0.52-0.74

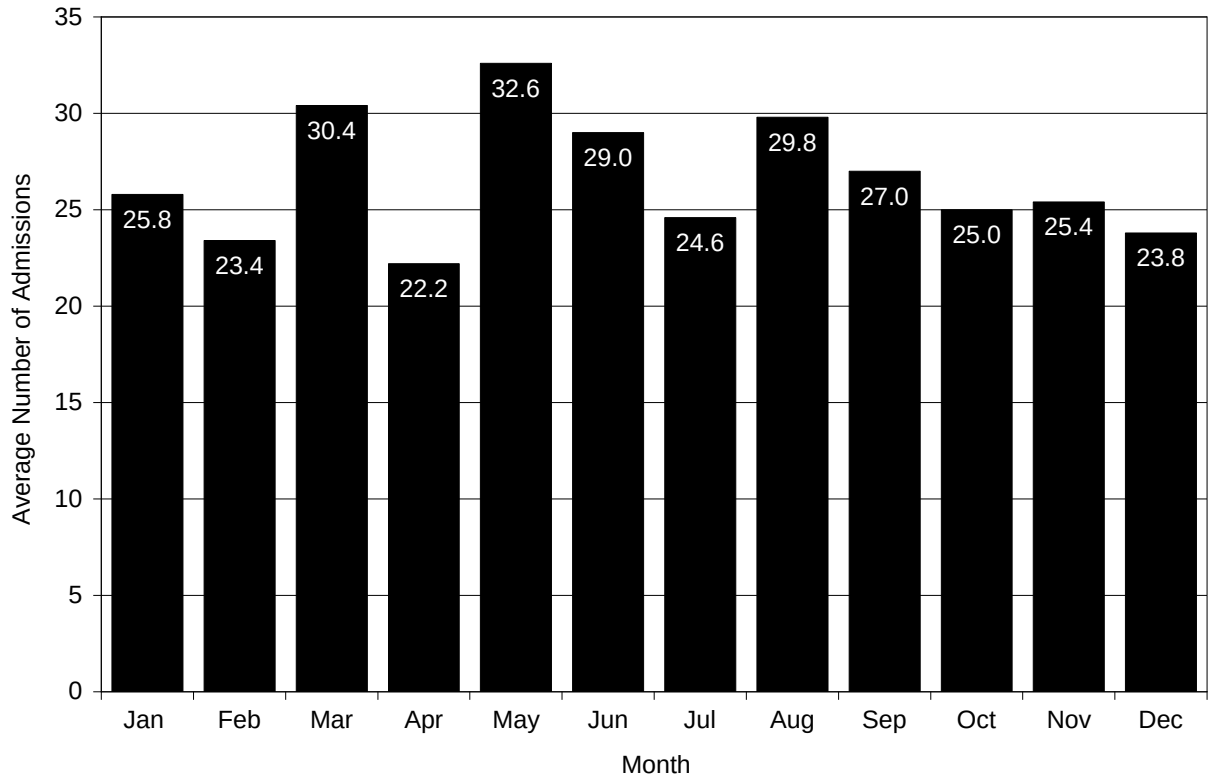
Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset. Note: Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Figure 26. Hospital Admissions for Gastro-Oesophageal Reflux in Infants <1 Year by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised with the exception of the Any / Sole Classification (see page 333 for details). GOR: Gastro-Oesophageal Reflux.

Figure 27. Average Number of Hospital Admissions for Gastro-Oesophageal Reflux in Infants <1 Year per Month, New Zealand 2003-2007



Source: National Minimum Dataset; Numbers are monthly averages.

Gastro-Oesophageal Reflux Admissions amongst Pacific Groups in New Zealand

In New Zealand during 2003-2007, gastro-oesophageal reflux admissions amongst Any and Sole Samoan, Tongan and Cook Island Māori infants were *significantly lower* than for non-Māori non-Pacific infants. Small numbers however precluded valid comparisons for other Pacific groups, with the exception of Any Fijian infants, where rates were similar to those of non-Māori non-Pacific infants (**Table 19**).

Table 19. Distribution of Hospital Admissions for Gastro-Oesophageal Reflux in Pacific Infants <1 Year by Pacific Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	36	7.2	1.57	0.21	0.15-0.30
Any Tongan	6	1.2	0.60	0.08	0.04-0.18
Any Cook Island Māori	17	3.4	1.58	0.21	0.13-0.35
Any Niuean	<5	s	s	s	s
Any Fijian	12	2.4	8.34	1.13	0.64-1.99
Any Tokelauan	<5	s	s	s	s
Any Other Pacific	0	0	-	-	-
Any Pacific	77	15.4	1.70	0.23	0.18-0.29
Any Māori	196	39.2	2.27	0.31	0.26-0.36
Non-Māori Non-Pacific	1,332	266.4	7.37	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	23	4.6	2.30	0.31	0.21-0.47
Sole Tongan	5	1.0	0.99	0.13	0.06-0.32
Sole Cook Island Māori	11	2.2	3.85	0.52	0.29-0.94
Sole Niuean	<5	s	s	s	s
Sole Fijian	<5	s	s	s	s
Sole Tokelauan	0	0	-	-	-
Sole Other Pacific	0	0	-	-	-
Sole Pacific	46	9.2	2.34	0.32	0.24-0.42
Sole Māori	138	27.6	4.19	0.57	0.48-0.68
Non-Māori Non-Pacific	1,332	266.4	7.37	1.00	

Source: Numerator-National Minimum dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); RR: Rate ratios are compared to the Non-Māori Non-Pacific group and are unadjusted; s: small numbers preclude rate calculation.

Summary

In New Zealand during 1996-2007, gastro-oesophageal reflux admissions in infants initially increased, reached a peak in 2000-01 and thereafter declined. During 2003-2007, admissions peaked at 4-7 weeks of age, with numbers then tapering off progressively until 28-31 weeks, after which they became relatively static. While admissions were *significantly lower* for Pacific infants than for European infants, rates were *significantly higher* for males and those in urban or very affluent (NZDep Decile 1) areas (compared to those in very deprived (NZDep Decile 10) areas). During the same period, admissions for Any and Sole Samoan, Tongan and Cook Island Māori infants were *significantly lower* than for non-Māori non-Pacific infants. Small numbers however precluded valid comparisons for other Pacific groups, with the exception of Any Fijian infants, where rates were similar to those of non-Māori non-Pacific infants.

Local Policy Documents and Evidence Based Reviews Relevant to the Management of Gastro-Oesophageal Reflux

In New Zealand at present, there are no policy documents which address population level approaches to gastro-oesophageal reflux in infants. In addition, while the international literature provides some guidance as to the most effective approaches in the individual patient, there is a paucity of reviews considering the prevention of gastro-oesophageal reflux at the population level. Thus by necessity, **Table 20** restricts its focus to international reviews which consider the optimal treatment of gastro-oesophageal reflux at the individual level.

Table 20. Local Policy Documents and Evidence Based Reviews Relevant to the Management of Gastro-Oesophageal Reflux in Infants

Ministry of Health Policy Documents
There are no New Zealand policy documents which focus on the prevention or management of gastro-oesophageal reflux in infants. However, problems associated with infant feeding in general are considered in more detail in the Breastfeeding section (**Page 58**).
Systematic and Other Reviews from the International Literature
There are no systematic reviews which focus on the prevention of GOR at the population level. A range of reviews however, consider approaches to treatment in the individual patient. These include:
Pritchard D, Baber N, Stephenson T. **Should Domperidone be Used for the Treatment of Gastro-Oesophageal Reflux in Children: Systematic Review of Randomised Controlled Trials in Children Aged 1 Month to 11 Years Old**. British Journal of Clinical Pharmacology, 2005. 59(6):725-29 This review (which considered four randomised controlled trials (RCTs)), assessed the efficacy of domperidone for the treatment GOR symptoms in children and concluded that there was no robust evidence supporting its use for GOR in this age group.
Craig W, Hanlon-Dearman A, Sinclair C, et al. **Metoclopramide, Thickened Feedings, and Positioning for Gastro-Oesophageal Reflux in Children Under Two Years**. Cochrane Database of Systematic Reviews 2004, Issue 3 This review found in that in developmentally normal children aged 1 month to 2 years, thickened feeds reduced the outward signs of reflux; that elevation of the head of the bed had little effect; and that metoclopramide was more effective than placebo in reducing the number of daily symptoms and the reflux index. Metoclopramide however, caused more side effects than placebo, with the natural history of uncomplicated GOR being that it will get better without treatment.
Huang R, Forbes D, Davies M. **Feed Thickener for Newborn Infants with Gastro-Oesophageal Reflux.** Cochrane Database of Systematic Reviews 2002, Issue 3 Many newborn babies (in the first 4 weeks of life) suffer from gastro-oesophageal reflux, especially if premature. Thickening the milk feed is a simple manoeuvre and commonly used as first line treatment for gastro-oesophageal reflux. Thickening the feeds can be used with or without other treatments such as positioning babies on their stomach or side, and using medications that suppress acid in the stomach or cause food to move more rapidly through the stomach. No RCTs of sufficient quality were found in this review. Therefore, there is no current evidence to support or refute the use of feed thickeners in treating newborn babies with gastro-oesophageal reflux.
Augood C, MacLennan S, Gilbert R, Logan S. **Cisapride Treatment for Gastro-Oesophageal Reflux in Children.** Cochrane Database of Systematic Reviews 2003, Issue 4 This review found no clear evidence that Cisapride reduced symptoms of GOR, with the results suggesting substantial publication bias favouring studies showing a positive effect. Due to reports of fatal cardiac arrhythmias and sudden death, from July 2000 Cisapride has been restricted in the USA and Europe, to those on limited access programmes supervised by a paediatric gastrologist, or to patients treated in clinical trials, safety studies or registry programmes.

ISSUES MORE COMMON IN CHILDREN

Total and Avoidable Morbidity and Mortality

Most Frequent Causes of Hospital Admissions and Mortality in Children

Introduction

Before considering any of the more detailed analyses which follow, it is worthwhile briefly reviewing the most frequent causes of hospital admission and mortality for New Zealand's Pacific children during the past five years. It is hoped that the brief summary tables presented below will provide the reader with an overall context, within which to consider the relative importance of the various health issues experienced by Pacific children in New Zealand in recent years.

Data Source and Methods

Definition

1. Most Frequent Causes of Post-Neonatal Mortality in Infants (29-364 days) and Children (1-14 yrs)
2. Most Frequent Causes of Hospital Admission in Children (29 days-14 yrs)

Data Sources and Interpretation

1. Most Frequent Causes of Mortality in Infants (29-364 days) and Children (1-14 yrs)

Numerator: National Mortality Collection: Post-Neonatal Deaths in Infants (29-364 days) and Children (1-14 yrs) by main underlying cause of death

Denominator: Infants: Birth Registration Dataset; Children: NZ Census

2. Most Frequent Causes of Hospital Admission in Children (29 days-14 yrs)

Numerator: National Minimum Dataset: Post-Neonatal hospital admissions for children (29 days -14 years). For acute and arranged admissions, the reason for admission was derived from the primary diagnosis (ICD-10) code, while for waiting list admissions this was derived from the primary procedure (ICD-10) code.

Denominator: NZ Census

Notes on Interpretation

Note 1: To maintain consistency with the injury and mental health sections, injury and mental health inpatient admissions with an Emergency Medicine Specialty Code (M05-M08) on discharge were excluded (see *Appendix 4: The National Minimum Dataset* for rationale). In addition, the ACC admission type code was retired in 2004, potentially resulting in a spurious reduction in the number of children admitted under ACC.

Note 2: Tests of statistical significance have not been applied to the data in this section, and thus any associations described do not imply statistical significance or non-significance.

Indicator Category

Admissions: Proxy B-C; Mortality: Ideal B

Hospital Admissions and Mortality in New Zealand

Most Frequent Causes of Mortality

During 2001-2005, SUDI related diagnoses were the leading cause of post-neonatal mortality for Any Pacific infants, while congenital anomalies were the leading cause for Sole Pacific infants. In contrast, injury / poisoning was the leading cause of mortality for both Any and Sole Pacific children aged 1-14 years, followed by congenital anomalies and neoplasm (**Table 21**).

Most Frequent Causes of Hospital Admission

Any Pacific Children: During 2003-2007 bronchiolitis, injury / poisoning and asthma were the leading reasons for acute hospital admissions, while neoplasm / chemotherapy / radiotherapy and injury / poisoning were the leading reasons for arranged admissions. Dental procedures and grommets were the leading reasons for waiting list admissions for Any Pacific children 0-14 years (**Table 22**).

Sole Pacific Children: During 2003-2007, bronchiolitis, injury / poisoning and pneumonia were the leading reasons for acute hospital admissions, while neoplasm / chemotherapy / radiotherapy and injury / poisoning were the leading reasons for arranged admissions. Dental procedures and grommets were the leading reasons for waiting list admissions for Sole Pacific children 0-14 years (**Table 22**).

Table 21. Most Frequent Causes of Mortality Outside of the Neonatal Period, Any and Sole Pacific vs. New Zealand Children 0-14 Years, 2001-2005

Post-Neonatal (29-364 Days)				
Cause of Death	Number: Total 2001-2005	Number: Annual Average	Rate per 100,000	% Deaths in Age Group
Any Pacific				
SUDI: SIDS	21	4.2	49.29	17.2
SUDI: Suffocation/Strangulation in Bed	15	3.0	35.21	12.3
SUDI: Unspecified	7	1.4	16.43	5.7
Congenital Anomalies: CNS	10	2.0	23.47	8.2
Congenital Anomalies: CVS	8	1.6	18.78	6.6
Congenital Anomalies: Other	11	2.2	25.82	9.0
Injury / Poisoning	6	1.2	14.08	4.9
Other Perinatal Conditions	11	2.2	25.82	9.0
Other Causes	33	6.6	77.46	27.0
Total	122	24.4	286.35	100.0
Sole Pacific				
SUDI: SIDS	10	2.0	51.93	14.7
SUDI: Suffocation/Strangulation in Bed	5	1.0	25.96	7.4
SUDI: Unspecified	<5	s	s	s
Congenital Anomalies: CNS	9	1.8	46.73	13.2
Congenital Anomalies: CVS	6	1.2	31.16	8.8
Congenital Anomalies: Other	6	1.2	31.16	8.8
Injury / Poisoning	<5	s	s	s
Other Perinatal Conditions	6	1.2	31.16	8.8
Other Causes	22	4.4	114.24	32.4
Total	68	13.6	353.10	100.0
Children 1-14 Years				
Cause of Death	Number: Total 2001-2005	Number: Annual Average	Rate per 100,000	% Deaths in Age Group
Any Pacific				
Injury / Poisoning	48	9.6	11.20	42.5
Congenital Anomalies	21	4.2	4.90	18.6
Neoplasm	11	2.2	2.57	9.7
All Other Causes	33	6.6	7.70	29.2
Total	113	22.6	26.37	100.0
Sole Pacific				
Injury / Poisoning	30	6.0	13.27	38.5
Congenital Anomalies	15	3.0	6.64	19.2
Neoplasm	10	2.0	4.42	12.8
All Other Causes	23	4.6	10.18	29.5
Total	78	15.6	34.51	100.0

Source: Numerator-National Mortality Collection; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); CNS: central nervous system; CVS: cardiovascular system; SIDS: Sudden Infant Death Syndrome; SUDI: Sudden Unexpected Death in Infancy; s: small numbers preclude rate calculation.

Table 22. Most Frequent Causes of Post-Neonatal Hospital Admissions in Any Pacific Children 0-14 Years, New Zealand 2003-2007

Any Pacific				
Primary Diagnosis / Procedure	Number: Total 2003-2007	Rate per 1,000	% of Type	% of Total
Acute Admissions (by Primary Diagnosis)				
Bronchiolitis	6,042	12.29	11.8	8.3
Injury / Poisoning	5,903	12.01	11.5	8.1
Asthma	5,008	10.19	9.8	6.9
Bacterial/Viral Pneumonia	4,808	9.78	9.4	6.6
Acute URTI	3,376	6.87	6.6	4.7
Serious Skin Infections	3,313	6.74	6.5	4.6
Infectious Gastroenteritis	3,308	6.73	6.5	4.6
Viral Infection NOS	2,958	6.02	5.8	4.1
Urinary Tract Infection	1,218	2.48	2.4	1.7
Abdominal/Pelvic Pain	729	1.48	1.4	1.0
All Other Diagnoses	14,451	29.40	28.3	19.9
Total	51,114	103.99	100.0	70.4
Arranged Admissions (by Primary Diagnosis)				
Neoplasm/Chemotherapy/Radiotherapy	984	2.00	16.5	1.4
Injury/Poisoning	568	1.16	9.5	0.8
Dialysis	448	0.91	7.5	0.6
Dental Conditions	385	0.78	6.4	0.5
Immune Disorders	278	0.57	4.7	0.4
All Other Diagnoses	3,314	6.74	55.4	4.6
Total	5,977	12.16	100.0	8.2
Waiting List Admissions (by Primary Procedure)				
Dental Procedures	3,913	7.96	25.9	5.4
Grommets	3,796	7.72	25.1	5.2
No Procedure Listed	984	2.00	6.5	1.4
Tonsillectomy +/- Adenoidectomy	652	1.33	4.3	0.9
Skin/Subcutaneous Tissue Procedures	421	0.86	2.8	0.6
All Other Procedures	5,346	10.88	35.4	7.4
Total	15,112	30.75	100.0	20.8
ACC Admissions				
Total ACC Admissions	358	0.73	100.0	0.5
Total	72,561	147.62	100.0	100.0

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Injury and Mental Health Emergency Department Cases Removed (See Appendix 4 for Rationale). ACC admission type code was retired in 2004, potentially resulting in a spurious reduction in the number of children admitted under ACC.

Figure 28. Most Frequent Causes of Post-Neonatal Hospital Admissions for Sole Pacific Children 0-14 Years, New Zealand 2003-2007

Sole Pacific				
Primary Diagnosis / Procedure	Number: Total 2003-2007	Rate per 1,000	% of Type	% of Total
Acute Admissions (by Primary Diagnosis)				
Bronchiolitis	4,770	18.98	12.2	8.8
Injury/Poisoning	4,440	17.67	11.4	8.2
Bacterial/Viral Pneumonia	3,901	15.52	10.0	7.2
Asthma	3,670	14.60	9.4	6.8
Serious Skin Infections	2,596	10.33	6.6	4.8
Acute URTI	2,572	10.23	6.6	4.8
Infectious Gastroenteritis	2,474	9.85	6.3	4.6
Viral Infection NOS	2,264	9.01	5.8	4.2
Urinary Tract Infection	978	3.89	2.5	1.8
Fever of Unknown Origin	578	2.30	1.5	1.1
All Other Diagnoses	10,825	43.08	27.7	20.0
Total	39,068	155.46	100.0	72.3
Arranged Admissions (by Primary Diagnosis)				
Neoplasm/Chemotherapy/Radiotherapy	765	3.04	18.8	1.4
Injury/Poisoning	433	1.72	10.6	0.8
Immune Disorders	270	1.07	6.6	0.5
Dental Conditions	264	1.05	6.5	0.5
Serious Skin Infections	89	0.35	2.2	0.2
All Other Diagnoses	2,245	8.94	55.2	4.2
Total	4,066	16.18	100.0	7.5
Waiting List Admissions (by Primary Procedure)				
Dental Procedures	2,818	11.21	26.5	5.2
Grommets	2,622	10.43	24.7	4.9
No Procedure Listed	753	3.00	7.1	1.4
Tonsillectomy +/- Adenoidectomy	363	1.44	3.4	0.7
Myringoplasty	323	1.29	3.0	0.6
All Other Procedures	3,754	14.94	35.3	6.9
Total	10,633	42.31	100.0	19.7
ACC Admissions				
Total ACC Admissions	257	1.02	100.0	0.5
Total	54,024	214.98	100.0	100.0

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Injury and Mental Health Emergency Department Cases Removed (See Appendix 4 for Rationale). ACC admission type code was retired in 2004, potentially resulting in a spurious reduction in the number of children admitted under ACC

Summary

Mortality: During 2001-2005, SUDI was the leading cause of post-neonatal mortality for Any Pacific infants, while congenital anomalies were the leading cause for Sole Pacific infants. In contrast, injury / poisoning was the leading cause of mortality for both Any and Sole Pacific children aged 1-14 years, followed by congenital anomalies and neoplasm.

Hospital Admissions: During 2003-2007, bronchiolitis and injury / poisoning were the leading reasons for acute admissions in Any and Sole Pacific children. Neoplasm / chemotherapy / radiotherapy and injury / poisoning were the leading reasons for arranged admissions while dental procedures and grommets were the leading reasons for waiting list admissions.

Å In Depth Topic: Ambulatory Sensitive Hospitalisations in Children

Introduction

Ambulatory Sensitive Hospitalisations (ASH) reflect hospital admissions for conditions which could potentially be prevented by early access to treatment in primary care [160]. In many countries ASH are used as a means to assess the performance of primary care, or to document potential barriers to its access [161].

In New Zealand few publications have explored ambulatory sensitive hospitalisations amongst Pacific children, although a total population (0-74 years) review in the late 1990s noted that (age standardised) ASH rates for Pacific people were 70% higher than for European people. The authors concluded that there was significant scope for the health sector to contribute to population health gain, and in particular, to improve equity of outcomes across ethnic and socioeconomic groups [162].

In 2007 the Ministry of Health thus announced a new set of targets to focus resources and improve performance in 10 key areas. One of these targets was a reduction in ASH for children aged 0-4 years [163]. Before considering how ASH might be reduced in this age group however, it is important to review how ASH has been measured in the health sector to date, as well as some of the limitations associated with ASH as a tool. The following section thus considers each of these issues in turn, before exploring the distribution of ASH in Pacific children living in New Zealand using data from the National Minimum Dataset. The section concludes with links to other sections, which review population level interventions to address individual ASH conditions, before exploring a range of policy and evidence based review documents which consider how access to primary care might be improved in this age group.

The Use of ASH by the New Zealand Health Sector to Date

The Health Sector's Use of ASH to Date

New Zealand's conceptualisation of ASH during the past decade has been significantly influenced by the work of Jackson and Tobias [162], who in 2001 published a paper assigning all hospital admissions (based on their ICD-9 principal diagnosis code) to one of two mutually exclusive categories: Potentially Avoidable and Unavoidable. This categorisation was not meant to imply that every avoidable hospitalisation could in fact have been avoided, but rather that the potential to do so existed. Potentially Avoidable Hospitalisations were further sub-divided into three subcategories:

1. **Population Preventable Hospitalisations (PPH):** resulting from diseases preventable through population-based strategies (e.g. tobacco tax and legislation).
2. **Ambulatory Sensitive Hospitalisations (ASH):** resulting from diseases sensitive to preventative or therapeutic interventions deliverable in primary care (e.g. vaccine preventable diseases, early recognition and excision of melanoma).
3. **Hospitalisations Avoidable through Injury Prevention:** avoidable through interventions such as wearing seatbelts, domestic hot water temperature reduction.

In order to assign hospital admissions to each of these categories, Jackson and Tobias [162] developed a weighting system, which was based on each admission's ICD-9 principal diagnosis code and a hypothesis regarding the potential role each category played in prevention; for example, half of skin cancer admissions were considered preventable by population level interventions (e.g. sun smart campaigns) and half by early detection and treatment in primary care - thus 0.5 skin cancer admissions were assigned to the PPH category and 0.5 to the ASH category (10 skin cancer admissions = 5 PPH and 5 ASH). Similarly, asthma admissions were considered entirely preventable by early and appropriate management in primary care, so 100% of asthma admissions were assigned to the ASH

category (10 asthma admissions = 0 PPH and 10 ASH). The conditions included in Jackson and Tobias' coding algorithm, along with their respective weights are outlined in **Appendix 9**.

Filters Applied to ASH by the Ministry of Health

The coding algorithm created by Tobias and Jackson has been utilised by the Ministry of Health since the late 1990s to document ASH in both the adult and paediatric populations. In order to deal with the issue of inconsistent uploading of emergency department cases to the National Minimum Dataset however (see **Appendix 4**), the Ministry of Health has traditionally applied a number of filters to its ASH data sets. These filters **exclude** [164] [162]:

1. Admissions to private hospitals, small rural hospitals, maternity and neonatal services, mental health services and disability support services.
2. Accident and Emergency day cases which meet the following criteria:
    - the admission and discharge dates are the same AND,
    - the patient was not discharged dead (i.e., discharge type not in 'DD') AND,
    - the health specialty code is in ('M05', 'M06', 'M07', 'M08')

The impact of these filters is likely to vary significantly by DHB, with centres managing much of their ASH workload in specialist paediatric emergency departments likely to lose many more ASH cases to filtering than those assessing and managing their day cases on their paediatric wards (see **Appendix 4** for a more detailed discussion).

Factors Likely to Influence the Future Use of ASH in the Health Sector

During 2007, two developments occurred with the potential to significantly influence the way ASH is measured in the New Zealand paediatric population in future:

1. **The NZ Child and Youth Epidemiology Service (NZCYES) Paediatric ASH Project**: **Table 125** in **Appendix 9,** in addition to summarising the ASH weights which have been used in the health sector to date, also highlights the lack of relevance many of the current ASH conditions (e.g. colorectal cancer, ischaemic heart disease) have to the paediatric population. Further, it is likely that the role primary care plays in preventing such admissions varies with age (e.g. while most cases of epilepsy in adults can be managed effectively in primary care, a number of children presenting with their first non-febrile seizure may require hospital admission for further investigation). As a result, during 2007 NZCYES initiated a project to develop a new set of ASH codes which meet the needs of the paediatric population in New Zealand. These codes have been adopted by the Ministry of Health and are summarised in **Table 23**.
2. **The Ministry of Health's ASH Technical Advisory Group**: In 2007 the MOH formed a Technical Advisory Group (TAG) to oversee implementation of the new ASH Targets. This group has made a number of recommendations regarding how ASH should be monitored in the future, including the need for a coding algorithm which differentiates between the adult and paediatric (0-14 years) populations, the discontinuation of weighting for most ASH conditions and the exclusion of waiting list admissions (with the exception of dental caries) on the basis that waiting list admissions reflect different care pathways than those occurring for acute and semi-acute conditions (i.e. capacity issues at the secondary care level may potentially play a greater role in determining waiting list admissions than access to primary care).

Table 23. New Paediatric ASH Codes Developed for the New Zealand Health Sector

Ambulatory Sensitive Conditions	ICD 10 Coding
Asthma	J45, J46
Bronchiectasis	J47
Skin Infections	H000, H010, J340, L01-L04, L08, L980
Constipation	K590
Dental Caries	K02, K04, K05
Dermatitis and Eczema	L20-L30
Gastroenteritis	A02- A09, R11
Gastro-Oesophageal Reflux	K21
Nutritional Deficiency	D50- D53, E40-E46, E50- E56, E58-E61, E63, E64
Bacterial/Non Viral Pneumonia	J13-J16, J18
Rheumatic Fever / Heart Disease	I00-I09
Otitis Media	H65-H67
Acute Upper Respiratory Tract Infection	J00-J03, J06
Vaccine Preventable Diseases: Neonatal/Other Tetanus, Congenital Rubella ≥6 months: Pertussis, Diphtheria, Hepatitis B ≥16 months Measles, Mumps, Rubella	A35, A36, A37, A80, B16, B180, B181 A33, A34, P350, B05, B06, B26, M014
ASH Urinary Tract Infection > 4 years	N10, N12, N300, N390, N309, N136
Filters: Codes Apply to Children 0-14 Years (excluding the neonatal period) Acute and Arranged Admissions Only (except Dental Conditions where Waiting List included)	

Note: Coding Algorithm developed by Pip Anderson, Elizabeth Craig, Gary Jackson and Martin Tobias in conjunction with the New Zealand Child and Youth Epidemiology Service

Understanding ASH and its Limitations as a Tool

In addition to considering how ASH has been adapted for use in the New Zealand health sector, it is also important to understand what the tool is actually measuring, as well as some of the limitations to its use, as both have significant implications for those wishing to interpret and/or reduce ASH rates at the local level.

Firstly, as Jackson and Tobias have acknowledged [162], contemporary analyses of ASH are based on a primary diagnosis (ICD-9 or ICD-10) assigned by coders at the time of hospital discharge, and thus for any given case it is difficult to determine whether the admission could in fact have been prevented, given early and appropriate management in primary care (e.g. for some brittle asthmatics, the most appropriate management in primary care may be referral to hospital). Thus ASH analyses need to be interpreted as reflecting the fact that a particular class of hospital admission could potentially have been prevented, given access to a particular type of intervention in primary care, rather than that an individual child's hospital admission resulted from individual failures at the primary care level.

Secondly, Jackson and Tobias [162] also note that in New Zealand the composition of ASH varies significantly with age, with admissions during infancy and childhood (0-14 years) being predominantly for conditions which are abrupt in onset (hours-days) and infectious in origin (e.g. respiratory infections, gastroenteritis, asthma). In contrast, for adults (45-74 years) admissions are predominantly for chronic conditions (e.g. angina, myocardial infarction, CORD, congestive heart failure) whose onset is usually more gradual (months-years) [162]. Such differences potentially suggest that the windows of opportunity available for the primary care practitioner to prevent ASH may be much shorter in the paediatric population (e.g. hours, if early antibiotic treatment is to prevent pneumonia admissions during infancy vs. months-years if the same practitioner is to prevent an adult diabetic from developing cardiovascular complications). Thus different approaches to prevention may need to be developed for different age groups.

In this context, while ensuring early access to effective primary care is still likely to be of considerable value in reducing ASH in both age groups, in countries such as New Zealand, where large socioeconomic and ethnic disparities in child health remain [88], a greater emphasis may need to be placed on addressing those factors, often outside of the health sector, which drive the underlying burden of disease (e.g. household income, housing, nutrition, exposure to second hand cigarette smoke). This is because, even with optimal access, the ability of a primary care practitioner to prevent a paediatric pneumonia admission after the first crucial hours may be limited, but the opportunities available for a DHB to prevent paediatric respiratory infections via e.g. healthy housing projects and parental smoking cessation programmes may be considerable.

ASH Rates Amongst Pacific Children in New Zealand

The following section reviews ASH rates for Pacific children (0-4 years) in New Zealand using the old and new coding algorithms, in order to highlight the impact the proposed changes in coding will have on paediatric ASH admissions. The section concludes with links to other sections of this report, which consider separately, each of the conditions included in the new paediatric ASH algorithm, before briefly reviewing a range of publications which consider how access to primary care might be improved at the population level.

Data Sources and Methods

Definition

Post-Neonatal Hospital Admissions in Children (29 days - 4 yrs) with Ambulatory Care Sensitive Conditions

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions in children (aged 29 days-4 years) with ambulatory care sensitive conditions (see *Appendix 9: Ambulatory Sensitive Hospital Admissions* for the ICD-9 and ICD-10 coding algorithms used).
Denominator: NZ Census

Notes on Interpretation

Note 1*: Appendix 4: The National Minimum Dataset* outlines some of the limitations of the hospital admission dataset. The reader is urged to review this Appendix before interpreting any ASH trends.
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category Ideal B-C

Understanding the Old and New Coding Algorithms and Filters

The following sections review New Zealand's ASH rates in children 0-4 years (the new MOH Paediatric ASH Target) using the MOH's old coding algorithm (summarised in **Table 125**, **Appendix 9**), and the new NZCYES paediatric ASH algorithm (summarised in **Table 23**). While at the time of writing, the MOH has adopted the paediatric algorithm for monitoring its ASH (0-4 years) Target, a decision as to whether to continue to filter out emergency department (ED) cases has not yet been announced. As the inclusion or exclusion of ED cases is likely to significantly alter local ASH rates (as different DHBs upload their ED cases to the National Minimum Dataset in different ways, with this issue being of particular importance to Auckland DHBs, where the majority of the Pacific population resides) all of the analyses which follow present both ED included and ED excluded figures, so that the impact of ED filtering on regional ASH rates can be fully realised (Note: In contrast to the MOH filters described above, all ED cases have either been totally included or excluded, not just those admitted and discharged on the same day (as in the paediatric population many presentations occur late in the evening, with children then being discharged in the early hours of the following day, potentially making their total length of stay similar to that of ED day cases). In addition, as previously discussed, all analyses using the new paediatric ASH codes include only acute and arranged admissions, with the exception of dental admissions (which also include waiting list admissions - as some DHBs routinely process dental admissions as waiting list admissions, and others as arranged admissions, potentially creating artefactual DHB differences if the entire burden of dental morbidity is not captured).

New Zealand Distribution and Trends

ASH Distribution by Diagnosis

Sole and Any Pacific: During 2003-2007, bacterial / non-viral pneumonia, asthma and gastroenteritis made the greatest contribution to ASH rates for both Any and Sole Pacific children (0-4 years) if ED cases were included, while bacterial / non viral pneumonia, asthma and dental conditions made the greatest contribution if ED cases were excluded. During this period, ASH rates were higher for Sole Pacific > Any Pacific > Total New Zealand children (**Table 25**). **New Zealand:** In New Zealand during 2003-2007, gastroenteritis, asthma and acute upper respiratory tract infections (URTIs) made the greatest contribution to ASH rates in children 0-4 years, followed by dental conditions and pneumonia. While the exclusion of ED cases reduced admissions across all categories, this ranking remained unchanged irrespective of whether ED cases were included or excluded (**Table 24**).

New Zealand Trends

In New Zealand during 1990-2007, changing from the old to the new ASH coding algorithm resulted in a large reduction in ASH rates for children aged 0-4 years. Despite this reduction, trends in ASH rates were very similar, with large increases in ASH rates during the 1990s, which began to plateau in the 2000s (and using the old algorithm, declined more recently). The impact filtering out ED cases had on these trends was marked however, with much of the growth in ASH rates in the 1990s being due to ED cases (**Figure 29**).

Table 24. Ambulatory Sensitive Hospitalisations in Children 0-4 Years by Primary Diagnosis, Using the New ASH Coding Algorithm, New Zealand 2003-2007

ASH Diagnosis	Emergency Department Admissions INCLUDED				Emergency Department Admissions EXCLUDED			
	Number: Total 2003-07	Number: Annual Average	Rate per 1000	% of Total	Number: Total 2003-07	Number: Annual Average	Rate per 1000	% of Total
Acute URTI excl Croup	15,669	3,133.8	11.43	17.5	12,522	2,504.4	9.13	16.4
ASH Dental	12,323	2,464.6	8.99	13.8	12,309	2,461.8	8.98	16.2
ASH Gastroenteritis	19,083	3,816.6	13.92	21.3	14,515	2,903.0	10.59	19.1
ASH Skin Infections	7,100	1,420.0	5.18	7.9	6,849	1,369.8	5.00	9.0
Asthma	15,684	3,136.8	11.44	17.5	12,757	2,551.4	9.30	16.8
Bacterial / Non-Viral Pneumonia	11,468	2,293.6	8.36	12.8	9,900	1,980.0	7.22	13.0
Bronchiectasis	221	44.2	0.16	0.2	216	43.2	0.16	0.3
Constipation	1,466	293.2	1.07	1.6	1,232	246.4	0.90	1.6
Dermatitis and Eczema	1,779	355.8	1.30	2.0	1,667	333.4	1.22	2.2
Gastro-Oesophageal Reflux	1,426	285.2	1.04	1.6	1,296	259.2	0.95	1.7
Nutritional Disorders	182	36.4	0.13	0.2	168	33.6	0.12	0.2
Otitis Media	3,043	608.6	2.22	3.4	2,581	516.2	1.88	3.4
Rheumatic Fever / Heart Disease	19	3.8	0.01	0.0	18	3.6	0.01	0.0
VPD ≥6 Months: DTP, Polio, Hep B	113	22.6	0.08	0.1	100	20.0	0.07	0.1
VPD ≥16 Months: MMR	16	3.2	0.01	0.0	12	2.4	0.01	0.0
Total	89,592	17,918.4	65.34	100.0	76,142	15,228.4	55.53	100.0

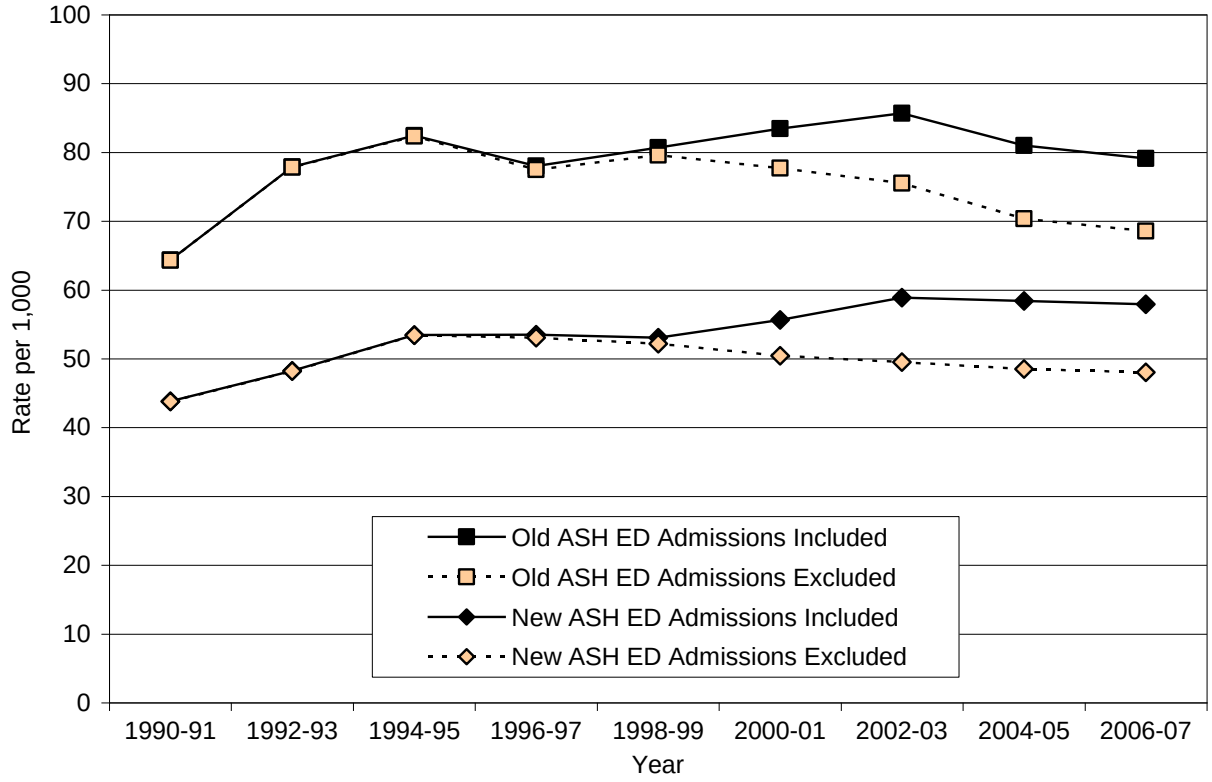
Source: Numerator - National Minimum Dataset; Denominator - Census. Note: URTI: Upper Respiratory Tract Infection; VPD: Vaccine Preventable Disease; DTP: Diphtheria, Tetanus, Pertussis; Hep B: Hepatitis B; MMR: Measles, Mumps, Rubella.

Table 25. Ambulatory Sensitive Hospitalisations for Pacific Children 0-4 Years by Primary Diagnosis, Using the New ASH Coding Algorithm, New Zealand 2003-2007

ASH Diagnosis	Any Pacific								Sole Pacific							
	Emergency Department Admissions INCLUDED				Emergency Department Admissions EXCLUDED				Emergency Department Admissions INCLUDED				Emergency Department Admissions EXCLUDED			
	Number: Total 2003-07	Number: Annual Average	Rate per 1,000	% of Total	Number: Total 2003-07	Number: Annual Average	Rate per 1,000	% of Total	Number: Total 2003-07	Number: Annual Average	Rate per 1,000	% of Total	Number: Total 2003-07	Number: Annual Average	Rate per 1,000	% of Total
Acute URTI excl Croup	2,335	467.0	13.56	12.8	1,455	291.0	8.45	10.3	1,763	352.6	22.24	12.9	1,064	212.8	13.42	10.1
ASH Dental	2,487	497.4	14.45	13.7	2,483	496.6	14.42	17.5	1,759	351.8	22.19	12.9	1,756	351.2	22.15	16.7
ASH Gastroenteritis	2,775	555.0	16.12	15.2	1,664	332.8	9.67	11.8	2,057	411.4	25.95	15.1	1,206	241.2	15.21	11.5
ASH Skin Infections	2,091	418.2	12.15	11.5	2,001	400.2	11.62	14.1	1,611	322.2	20.32	11.8	1,541	308.2	19.44	14.7
Asthma	3,608	721.6	20.96	19.8	2,534	506.8	14.72	17.9	2,633	526.6	33.21	19.3	1,797	359.4	22.67	17.1
Bacterial/Non-Viral Pneumonia	3,727	745.4	21.65	20.5	3,049	609.8	17.71	21.5	3,019	603.8	38.08	22.1	2,464	492.8	31.08	23.4
Bronchiectasis	87	17.4	0.51	0.5	85	17.0	0.49	0.6	71	14.2	0.90	0.5	70	14.0	0.88	0.7
Constipation	109	21.8	0.63	0.6	69	13.8	0.40	0.5	66	13.2	0.83	0.5	38	7.6	0.48	0.4
Dermatitis and Eczema	455	91.0	2.64	2.5	419	83.8	2.43	3.0	334	66.8	4.21	2.4	308	61.6	3.89	2.9
Gastro-Oesophageal Reflux	67	13.4	0.39	0.4	60	12.0	0.35	0.4	43	8.6	0.54	0.3	39	7.8	0.49	0.4
Nutritional Disorders	33	6.6	0.19	0.2	28	5.6	0.16	0.2	26	5.2	0.33	0.2	23	4.6	0.29	0.2
Otitis Media	399	79.8	2.32	2.2	291	58.2	1.69	2.1	266	53.2	3.36	1.9	190	38.0	2.40	1.8
Rheumatic Fever/ Heart Disease	6	1.2	0.03	0.0	6	1.2	0.03	0.0	5	1.0	0.06	0.0	5	1.0	0.06	0.0
VPD >= 6 Months: DTP, Polio, HepB	16	3.2	0.09	0.1	11	2.2	0.06	0.1	12	2.4	0.15	0.1	8	1.6	0.10	0.1
VPD >= 16 Months: MMR	<5	s	s	s	<5	s	s	s	<5	s	s	s	<5	s	s	s
Total	18,198	3,639.6	105.70	100.0	14,157	2,831.4	82.23	100.0	13,667	2,733.4	172.40	100.0	10,510	2,102.0	132.58	100.0

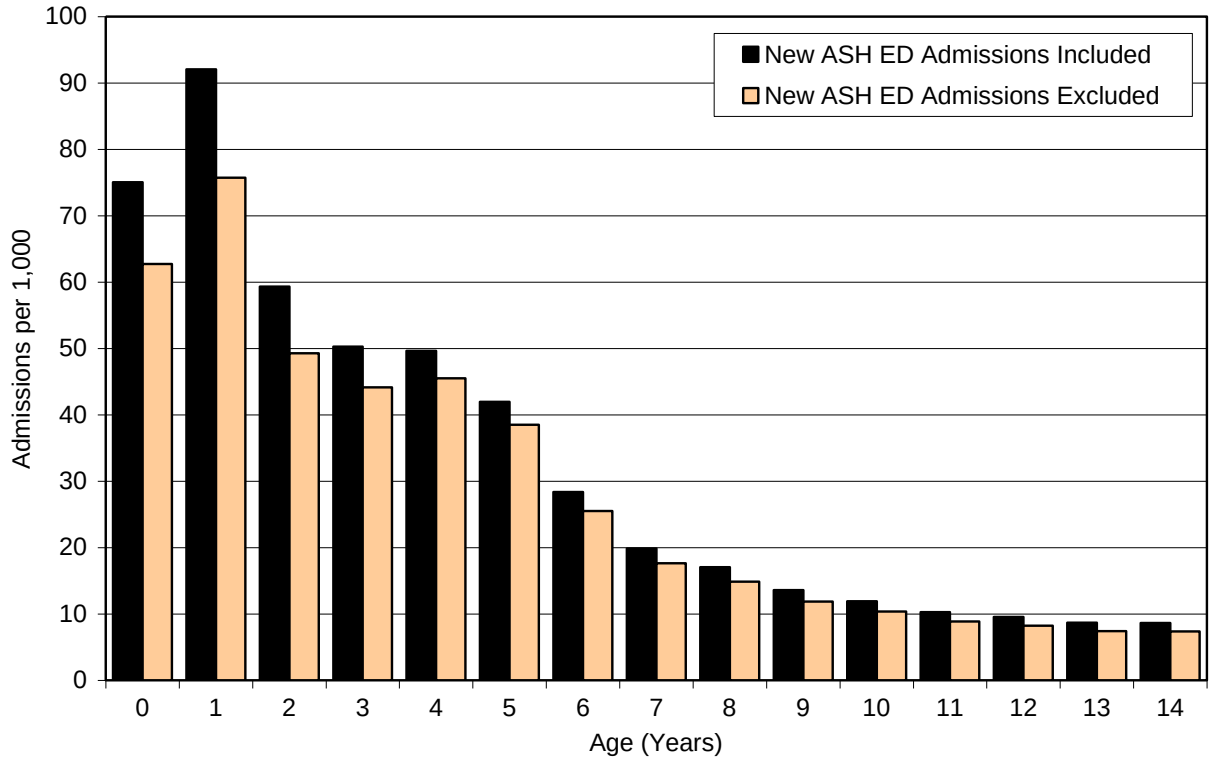
Source: Numerator - National Minimum Dataset; Denominator – Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details). URTI: Upper Respiratory Tract Infection; VPD: Vaccine Preventable Disease; DTP: Diphtheria, Tetanus, Pertussis; Hep B: Hepatitis B; MMR: Measles, Mumps, Rubella. s: Small numbers preclude rate calculation

Figure 29. Ambulatory Sensitive Hospitalisations in Children 0-4 Years, Using the Old and New ASH Coding Algorithms, New Zealand 1990-2007



Source: Numerator - National Minimum Dataset; Denominator - Census. Note: ED: Emergency Department.

Figure 30. Ambulatory Sensitive Hospitalisations in Children and Young People 0-24 Years by Age, Using the New ASH Coding Algorithm, New Zealand 2003-2007

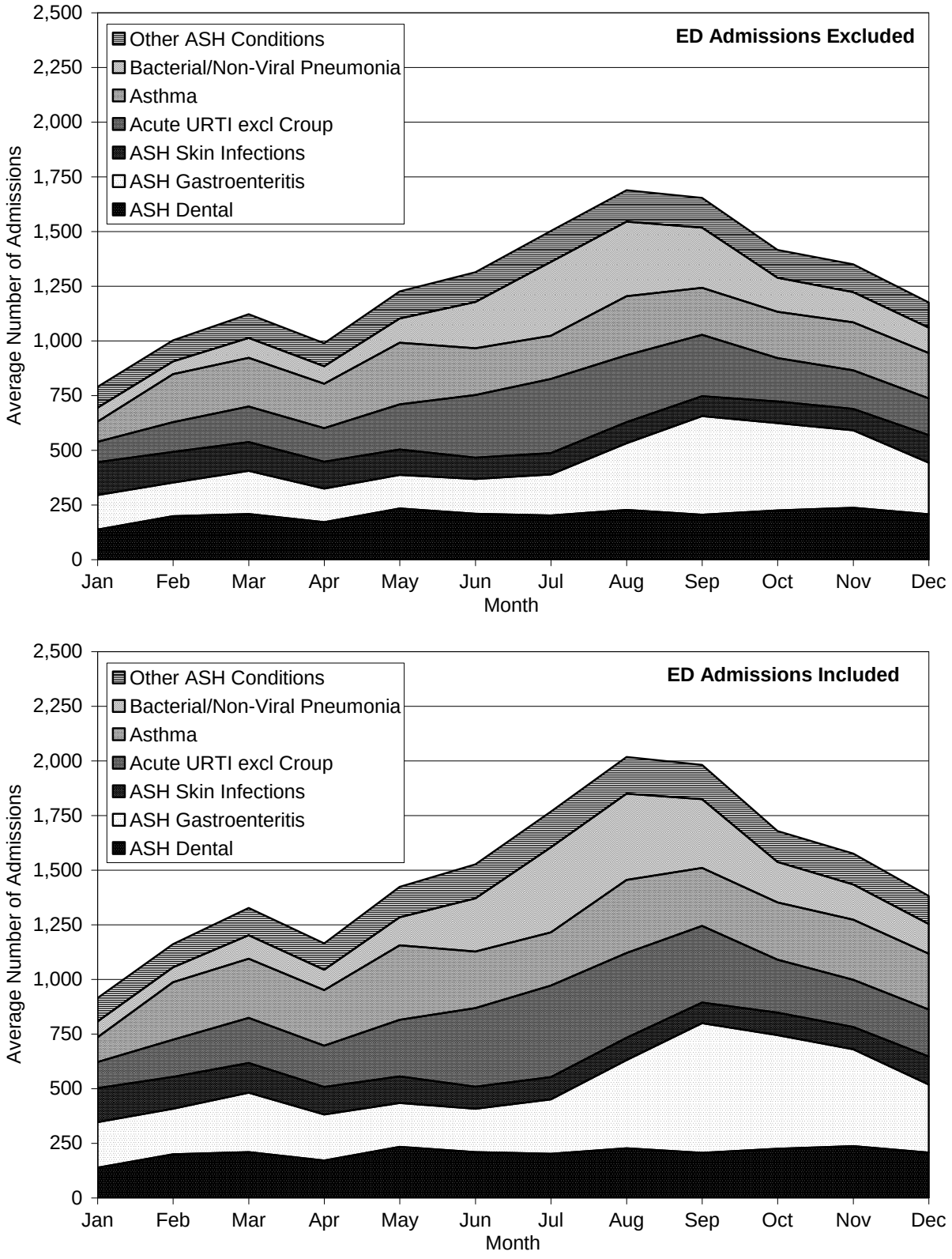


Source: Numerator - National Minimum Dataset; Denominator - Census. Note: ED: Emergency Department.

New Zealand Distribution by Age

In New Zealand during 2003-2007, ASH admissions (using the new algorithm) were highest in children aged 1 year, with rates tapering off markedly thereafter (**Figure 30**).

Figure 31. Average Number of ASH Admissions per Month in Children 0-4 Years by Diagnosis, Using the New Coding Algorithm, New Zealand 2003-2007



Source: National Minimum Dataset. ED: Emergency Department

Distribution by Season

In New Zealand during 2003-2007, ASH admissions in children 0-4 years were highest during late winter and early spring, irrespective of whether ED cases were included or excluded (**Figure 31**)

Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

In New Zealand during 2003-2007, ASH rates were *significantly higher* for Pacific and Māori children, males and those living in urban or more deprived areas irrespective of whether ED cases were included or excluded. Rates for Asian children however, were *significantly higher* than for European children if ED cases were included, but *significantly lower* than for European children if ED cases were excluded (**Table 26**).

Table 26. Risk Factors for Ambulatory Sensitive Hospitalisations Using the New ASH Coding Algorithm in Children 0-4 Years, New Zealand 2003-2007

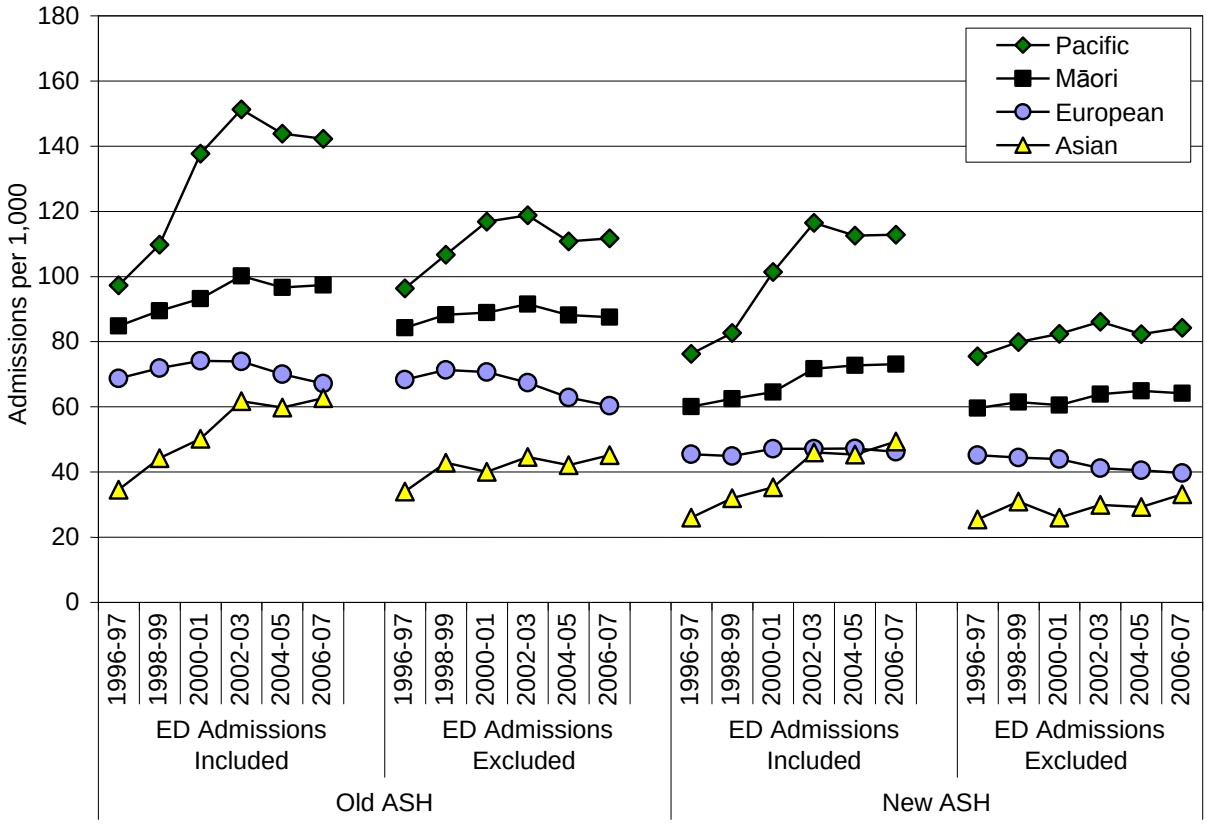
Variable	Emergency Department Admissions INCLUDED			Emergency Department Admissions EXCLUDED		
	Rate	RR	95% CI	Rate	RR	95% CI
NZ Deprivation Index Decile						
1	34.84	1.00		29.79	1.00	
2	34.75	1.00	0.96 - 1.04	28.33	0.95	0.91 - 0.99
3	38.89	1.12	1.07 - 1.16	31.82	1.07	1.02 - 1.12
4	48.76	1.40	1.35 - 1.45	41.87	1.41	1.35 - 1.46
5	50.56	1.45	1.40 - 1.51	42.18	1.42	1.36 - 1.47
6	61.63	1.77	1.71 - 1.83	51.83	1.74	1.67 - 1.81
7	66.23	1.90	1.84 - 1.97	57.05	1.91	1.84 - 1.99
8	87.01	2.50	2.42 - 2.58	73.21	2.46	2.37 - 2.55
9	95.43	2.74	2.65 - 2.83	81.91	2.75	2.65 - 2.85
10	104.06	2.99	2.89 - 3.08	90.08	3.02	2.92 - 3.13
NZ Deprivation Index Quintile						
1	34.79	1.00		29.07	1.00	
2	43.85	1.26	1.23 - 1.30	36.87	1.27	1.23 - 1.31
3	56.17	1.61	1.57 - 1.66	47.07	1.62	1.57 - 1.67
4	77.04	2.21	2.16 - 2.27	65.46	2.25	2.19 - 2.31
5	100.18	2.88	2.81 - 2.95	86.40	2.97	2.90 - 3.05
Ethnicity						
European	50.78	1.00		44.26	1.00	
Māori	83.50	1.64	1.62 - 1.67	75.20	1.70	1.67 - 1.73
Pacific	129.17	2.54	2.50 - 2.59	99.55	2.25	2.21 - 2.29
Asian	55.78	1.10	1.07 - 1.13	39.62	0.89	0.87 - 0.92
Gender						
Female	60.27	1.00		51.33	1.00	
Male	70.20	1.16	1.15 - 1.18	59.56	1.16	1.14 - 1.18
Rural / Urban						
Urban	69.36	1.00		58.39	1.00	
Rural	39.95	0.58	0.56 - 0.59	37.43	0.64	0.63 - 0.66

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Distribution by Prioritised Ethnicity

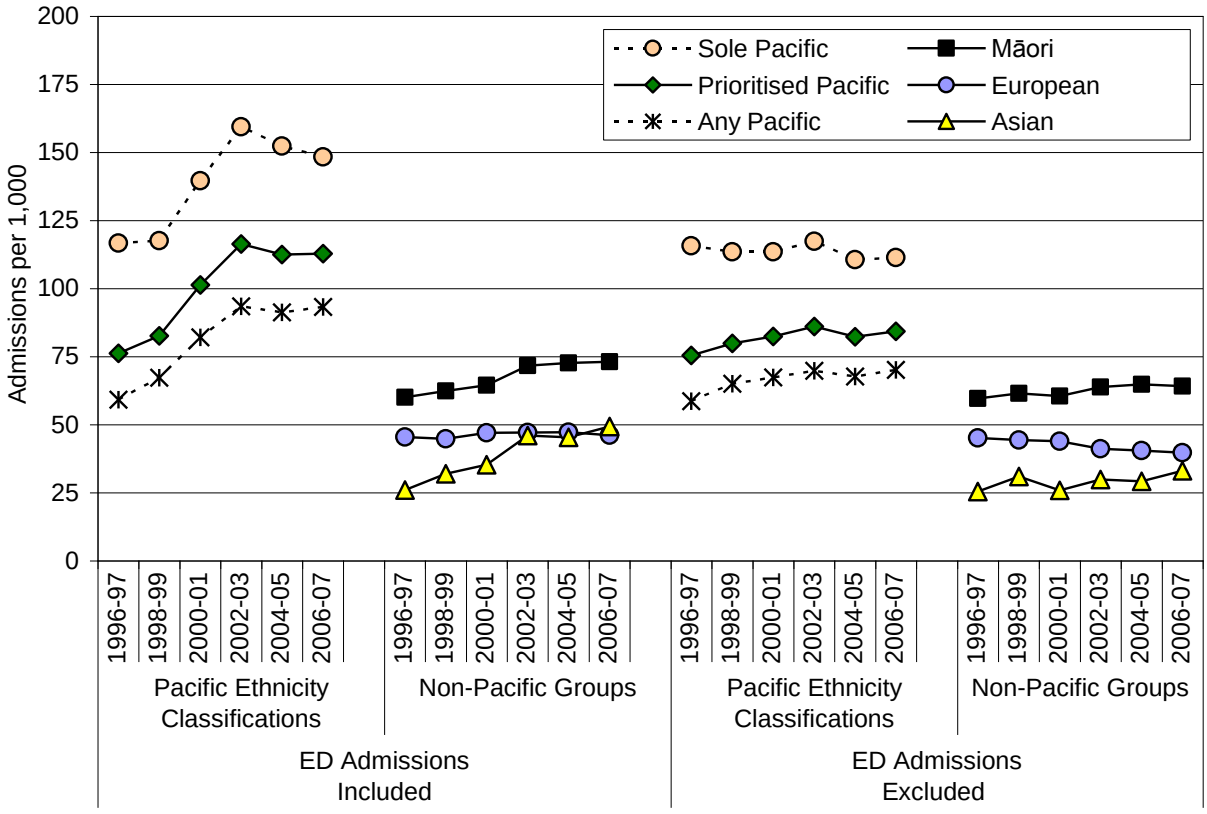
In New Zealand during 1996-2007, ASH rates were higher for Pacific > Māori > European and Asian children. While the largest increases in ASH rates were for Pacific and Asian children in the analyses where ED cases were included, it is possible that this may be a regional phenomenon (as disproportionate numbers of Pacific and Asian children live in the Auckland region, where the growth in the uploading of ED cases to the National Minimum Dataset has been the greatest) (**Figure 32**). Throughout this period, ASH admissions were higher for Sole Pacific than for Any Pacific children (**Figure 33**).

Figure 32. Ambulatory Sensitive Hospitalisations in Children 0-4 Years by Ethnicity, Using the Old and New ASH Coding Algorithms, New Zealand 1996-2007



Source: Numerator - National Minimum Dataset; Denominator – Census. Note: Ethnicity is Level 1 Prioritised. ED: Emergency Department.

Figure 33. Ambulatory Sensitive Hospitalisations in Children 0-4 Years by Ethnicity, Using the New ASH Coding Algorithms, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Ambulatory Sensitive Hospitalisations Amongst Pacific Groups in New Zealand

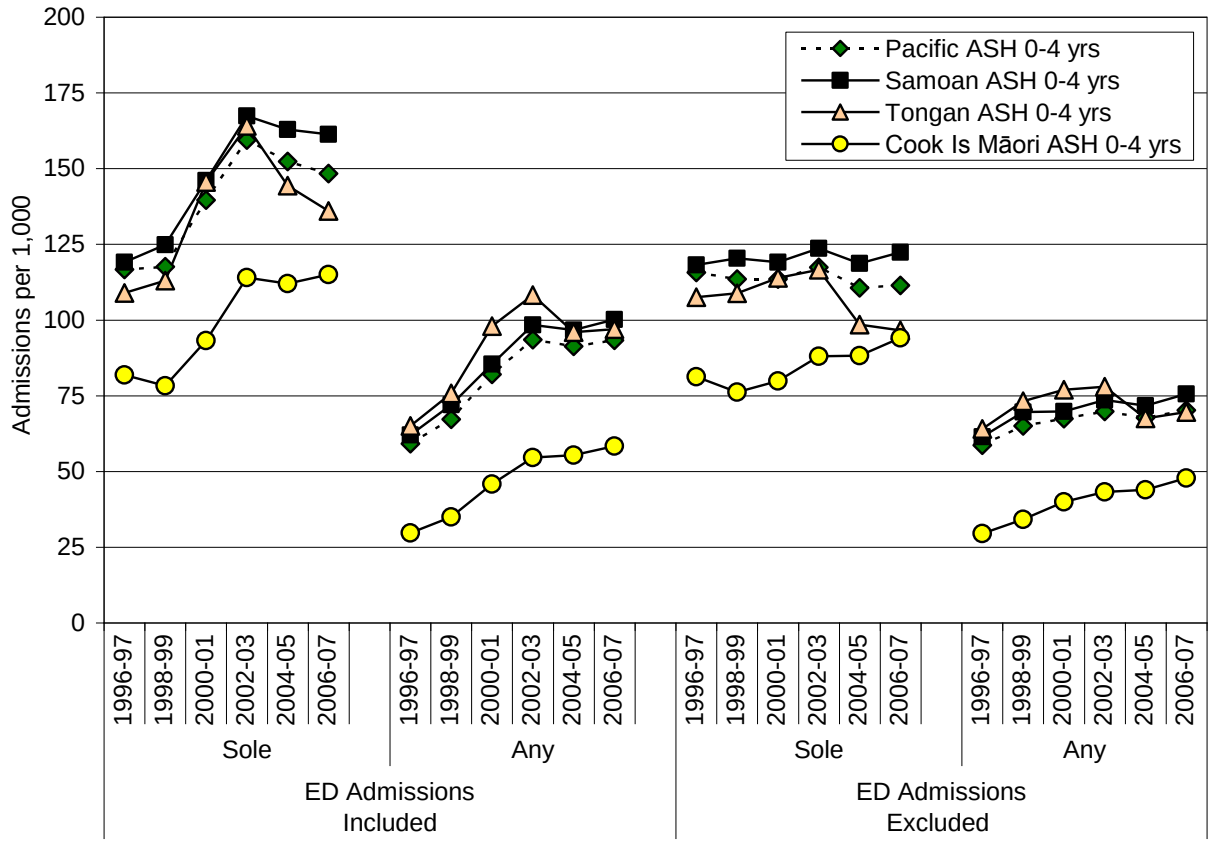
Pacific Group Trends

In New Zealand during 1996-2007, ASH rates were generally lower for Cook Island Māori children than for Samoan and Tongan children, although admissions for all three ethnic groups increased during this period. In addition, rates for children in the Sole ethnic groups were higher than for children in the Any ethnic groups throughout this period (**Figure 34**).

Distribution by Pacific Group

In New Zealand during 2003-2007 (using the Sole / Any classification), ASH admissions for Pacific children were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Groups, irrespective of whether ED cases were included or excluded. Within the Any categories, ASH admissions for Cook Island Māori, Niuean and Tokelauan children were *significantly lower* than for Samoan and Tongan children, irrespective of whether ED cases were included or excluded. Within the Sole Categories, ASH admissions for Cook Island Māori children were *significantly lower* than for Samoan and Tongan children if ED cases were included, and *significantly lower* than for Samoan children if ED cases were excluded (**Table 27**).

Figure 34. Ambulatory Sensitive Hospitalisations in Pacific Children 0-4 Years by Pacific Group Using the New ASH Coding Algorithm, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details). ED: Emergency Department.

Table 27. Distribution of Ambulatory Sensitive Hospitalisations in Pacific Children 0-4 Years by Pacific Group, Using the New ASH Coding Algorithm, New Zealand 2003-2007

Any Pacific										
Pacific Group	Emergency Department Admissions INCLUDED					Emergency Department Admissions EXCLUDED				
	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	9,716	1,943.2	111.63	2.23	2.19-2.28	7,546	1,509.2	86.70	2.05	2.00-2.10
Any Tongan	4,299	859.8	112.58	2.25	2.19-2.32	3,226	645.2	84.48	2.00	1.93-2.07
Any Cook Island Māori	2,751	550.2	67.15	1.34	1.29-1.39	2,299	459.8	56.11	1.33	1.27-1.38
Any Niuean	1,057	211.4	67.04	1.34	1.26-1.42	768	153.6	48.71	1.15	1.07-1.23
Any Fijian	536	107.2	103.40	2.07	1.91-2.24	410	82.0	79.09	1.87	1.70-2.05
Any Tokelauan	371	74.2	74.27	1.49	1.35-1.64	344	68.8	68.87	1.63	1.47-1.80
Any Other Pacific	512	102.4	94.55	1.89	1.74-2.06	393	78.6	72.58	1.71	1.56-1.89
Any Pacific	18,198	3,639.6	105.70	2.12	2.08-2.15	14,157	2,831.4	82.23	1.94	1.91-1.98
Any Māori	27,829	5,565.8	83.50	1.67	1.65-1.70	25,061	5,012.2	75.20	1.78	1.75-1.80
Non-Māori Non-Pacific	45,616	9,123.2	49.97	1.00		38,637	7,727.4	42.33	1.00	
Sole Pacific										
Pacific Group	Emergency Department Admissions INCLUDED					Emergency Department Admissions EXCLUDED				
	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	7,332	1,466.4	183.25	3.67	3.59-3.75	5,646	1,129.2	141.11	3.33	3.25-3.42
Sole Tongan	3,295	659.0	163.76	3.28	3.17-3.39	2,427	485.4	120.62	2.85	2.74-2.96
Sole Cook Island Māori	1,662	332.4	133.72	2.68	2.56-2.80	1,375	275.0	110.63	2.61	2.48-2.75
Sole Niuean	471	94.2	193.35	3.87	3.57-4.20	342	68.4	140.39	3.32	3.01-3.66
Sole Fijian	232	46.4	200.87	4.02	3.58-4.51	172	34.4	148.92	3.52	3.06-4.04
Sole Tokelauan	188	37.6	185.96	3.72	3.27-4.23	176	35.2	174.09	4.11	3.59-4.71
Sole Other Pacific	366	73.2	174.79	3.50	3.19-3.84	278	55.6	132.76	3.14	2.81-3.50
Sole Pacific	13,667	2,733.4	172.40	3.45	3.39-3.51	10,510	2,102.0	132.58	3.13	3.07-3.20
Sole Māori	20,961	4,192.2	161.84	3.24	3.19-3.29	19,068	3,813.6	147.22	3.48	3.42-3.54
Non-Māori Non-Pacific	45,616	9,123.2	49.97	1.00		38,637	7,727.4	42.33	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted.

Summary

During 2003-2007, bacterial / non-viral pneumonia, asthma and gastroenteritis made the greatest contribution to ASH rates for both Any and Sole Pacific children if ED cases were included, while bacterial / non viral pneumonia, asthma and dental conditions made the greatest contribution if ED cases were excluded. During the same period, ASH rates were *significantly higher* for Pacific and Māori children, males and those living in urban or more deprived areas irrespective of whether ED cases were included or excluded. Rates for Asian children however, were *significantly higher* than for European children if ED cases were included, but *significantly lower* than for European children if ED cases were excluded. Admissions were also higher during late winter and early spring.

During 2003-2007 (using the Sole / Any classification), ASH admissions for Pacific children were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Groups, irrespective of whether ED cases were included or excluded. Within the Any categories, ASH admissions for Cook Island Māori, Niuean and Tokelauan children were *significantly lower* than for Samoan and Tongan children, irrespective of whether ED cases were included or excluded. Within the Sole Categories, ASH admissions for Cook Island Māori children were *significantly lower* than for Samoan and Tongan children if ED cases were included, and *significantly lower* than for Samoan children if ED cases were excluded.

Policy Documents & Reviews Which Consider Approaches to Improving Access To, or the Quality Of, Primary Care

In considering how ASH rates might be reduced at a population level, two approaches are possible. The first involves exploring evidence based solutions to address each of the conditions contributing to ASH, while the second involves exploring specific interventions to improve access to and / or the effectiveness of, primary health care. This report has been structured to allow the reader to do both, with the sections listed below providing an overview of the distribution of individual ASH conditions, as well as the available literature on evidence based interventions to address them at the population level:

Gastro-Oesophageal Reflux (**Page 80**)	Vaccine Preventable Diseases (**Page193**)
Upper Respiratory Infections (**Page 123**)	Otitis Media (**Page 142**)
Rheumatic Fever & Heart Disease (**Page 221**)	Skin Infections (**Page 230**)
Asthma (**Page 167**)	Gastroenteritis (**Page 238**)
Pneumonia (**Page175**)	Dental Caries (**Page 270**)
Bronchiectasis (**Page182**)	Constipation (**Page 286**)

In addition, **Table 28** provides an overview of New Zealand policy documents and evidence based reviews which consider approaches to improving access to and/or the quality of primary health care. Rather than focusing solely on those aged 0-4 years (where the literature is limited), the table includes a variety of publications, which consider approaches to improving primary care more generally, as well as those which consider the most appropriate models for delivering primary health care to young people in different settings (Note: The methodology used to undertake this review is outlined in **Appendix 2**).

Table 28. Policy Documents and Reviews Which Consider Approaches to Improving Access To, or the Quality Of, Primary Care

Ministry of Health Policy Documents
The Primary Health Care Strategy. 2001, Ministry of Health: Wellington This strategy outlines a vision for primary health provision in New Zealand. It identifies as a priority reducing barriers, particularly financial barriers, for the groups with the greatest health need, both in terms of additional services to improve health, and to improve access to first-contact services. The strategy also signals a new direction in primary health care with an emphasis on population health, community involvement, health promotion and preventative care.
National Health Committee. **Improving Health for New Zealanders by Investing in Primary Care**. 2000. National Health Committee; Wellington. This report provided advice to the Minister, prior to the release of the Primary Health Care Strategy. It focused specifically on how primary health care (PHC) can reduce health inequalities by reaching individuals and groups in communities who are currently underserved, and also how improvements in health outcomes for communities can be achieved through population-based approaches. The report noted that there was adequate evidence that PHC had an independent effect on improving health status and reducing inequalities and also identified a number of barriers to primary care, which in turn contributed to health outcome inequalities: • The predominance of fee-for-service (FFS) payment for general practice services • Public funding for PHC not being allocated on the basis of need • Significant co-payments for many groups discouraging them from accessing PHC • The provision of ineffective services to some population groups • Effective services not being provided to people most likely to benefit. The report recommended that these barriers be addressed and that population-based approaches in primary care be fostered, with a view to improving the health of the whole population, and to helping to reduce health inequalities.
In addition, because of the central role that primary care plays in New Zealand's health system, access to, and the quality of, primary care is critical to a number of health strategies including: the **New Zealand Health Strategy** [165]; the **Child Health Strategy** [166]; the **Child and Youth Health Toolkit** [167]; the **New Zealand Disability Strategy** [168]; the **Well Child - Tamariki Ora National Schedule** Handbook[169]; **Immunisation in New Zealand Strategic Directions** 2003-2006[170]; the **DHB Toolkit: Improve Oral Health** [171]; **Pacific Child Health: A Paper for the Pacific Health and Disability Action Plan Review** [172].
Systematic and Other Reviews from the International Literature
Basu A & Brinson D. **The Effectiveness of Interventions for Reducing Ambulatory Sensitive Hospitalisations: Summary Report.** HSAC Report, 2008; 1(7).This publication summarises a recent systematic review [173] which reviewed the evidence for interventions and programmes that aim to reduce ambulatory sensitive hospitalisations. While the review was to look at evidence for the nine most common ASH conditions (adults included), this was restricted to those conditions which were best represented in the literature. The five categories of ASH focused on specifically were; All ASH, Asthma, Chronic Heart Failure, Diabetes and Other. Interventions which are considered in this review include; Comprehensive disease management programmes; Educational interventions; Telehealth applications; System level interventions; and Specialist clinics. A brief summary of the evidence for each of these interventions or programmes is provided.
Chown P, Kang M, Sanci L, et al. **Adolescent Health: Enhancing the Skills of General Practitioners in Caring for Young People from Culturally Diverse Backgrounds, GP Resource Kit 2nd Edition**. 2008. NSW Centre for the Advancement of Adolescent Health and Transcultural Mental Health Centre, Sydney. http://www.caah.chw.edu.au/resources/#03. This Resource Kit outlines the skills needed for working with the young person and their family, while addressing the developmental, cultural and environmental factors influencing their health status. It is intended as a practical guide for General Practitioners when providing health care to adolescents from culturally diverse backgrounds. While developed for the Australian context, it may also be useful in the NZ setting.

Committee on Adolescence American Academy of Pediatrics. **Achieving Quality Health Services for Adolescents**. Pediatrics, 2008. 121(6):1263-70.

This statement provides recommendations and criteria for assessing the quality of primary care delivered to adolescents in the United States. Consistent implementation of American Academy of Pediatrics recommendations (periodicity of visits and confidentiality issues), renewed attention to professional quality-improvement activities (access and immunisations) and public education, and modification of existing quality-measurement activities to ensure that quality is delivered are proposed as strategies that would lead to improved care for youth.

Cooper C, Wheeler D, Woolfenden S, et al. **Specialist Home-Based Nursing Services for Children with Acute and Chronic Illnesses**. Cochrane Database of Systematic Reviews 2006, Issue 4.

Specialist paediatric home-based nursing services for children with acute and chronic illnesses can potentially reduce hospital admission and length of stay, enhance health care in the community and reduce stress for families at the time of their child's illness. This review examines five randomised controlled trials (RCTs) of children aged 0-18 with acute and/or chronic illnesses allocated to specialist home-based nursing services compared with conventional medical care. Outcomes studied include utilisation of health care services, physical and mental health, satisfaction, adverse health outcomes and costs. Synthesis of the results of these RCTs was not appropriate because of heterogeneity in the types of service provided, the patients and outcome measures. Examination of the results of individual RCTs shows improved satisfaction with home-based care with no adverse impact on physical health outcomes for children. There is no evidence that specialist home-based nursing services reduce access to hospital services or length of stay. Further trials are required, measuring health, satisfaction, service utilisation and long-term cost evaluation.

Winnard D, Denny S, Fleming T. **Successful School Health Services for Adolescents. Best Practice Review**. 2005. Kidz First Community Health. Centre for Youth Health.

This review identifies current best practice in providing healthcare for adolescents in a school setting and is based on New Zealand and international literature. In addition, local youth health providers and stakeholders have provided guidance and input. Using the available evidence, it builds on the New Zealand Ministry of Health document, '*Improving the Health of Young People'* to provide more detail about the practical implementation of the principles outlined by the Ministry working party. The authors recommend that these guidelines need to be interpreted in light of the particular constraints and opportunities faced by each community when developing school-based health services. The literature review is organised into four areas describing the important components of effective school health services. The implications for service delivery and a summary and discussion of the literature that formed the basis of these guidelines, are also presented.

Gruen R, Weeramanthri T, Knight S, Bailie R. **Specialist Outreach Clinics in Primary Care and Rural Hospital Settings**. Cochrane Database of Systematic Reviews 2003, Issue 4.

This review examines the benefits and costs of outreach in a range of specialties and in a variety of settings. Simple 'shifted outpatients' styles of specialist outreach were shown to improve access, but there was no evidence of their impact on health outcomes. Outreach as part of more complex multifaceted interventions involving primary care collaborations, education and other services was associated with improved health outcomes, more efficient and guideline-consistent care, and less use of inpatient services. There is a need for better quality evidence evaluating specialist outreach in all settings, but especially in rural and disadvantaged populations.

Kainth A, McDaid C, Glanville J et al. **Telephone Consultations in Primary Care: A Scoping Review**.2003, Centre for Reviews and Dissemination, University of York. http://www.york.ac.uk/inst/crd/pdf/prptelephone.pdf

This review described the extent and nature of the existing literature relating to the benefits, harms and barriers to telephone consultations in primary care. The authors concluded there was very limited relevant literature in the following areas: the benefits of previous personal contact or access to medical records; improving access of disadvantaged groups; obstacles to increased telephone use; and more appropriate use of the route by patients and doctors. There was only slightly more evidence available regarding the most effective arrangements for telephone consultations; the skills and training required; and the best person to carry out telephone consultations, with a minority of these studies being of rigorous design. It appears that the largest and strongest primary evidence base exists in the area of the benefits and harms of telephone consultations to the patient and health professional, and it is in this area that a future systematic review investigating the effectiveness of telephone consultations might be considered.

Mathias K. **Youth-Specific Primary Health Care – Access, Utilisation and Health Outcomes**. 2002, NZHTA Report; 5(1).

This study was commissioned by the Ministry of Health to provide an evidence-based review of the effectiveness of youth-specific primary health care. The primary objectives were to assess the impacts of youth-specific primary care on access, utilisation, mental health, health outcomes and emergency department use. Secondary objectives were to describe factors that increase access and utilisation and improve health status in delivery of primary care services to youth, and to encourage outcome evaluations of youth health interventions. Evidence strongly supports enhanced access and utilisation of primary care and mental health services within primary care, by young people through youth-specific services. It suggests youth-specific primary care can reduce emergency department use. Currently, there is insufficient evidence to demonstrate changes in physical or mental health status through youth-specific primary health care. The author concludes there is an urgent need for further New Zealand and international research to determine the effectiveness of youth-specific primary health services.

Politzer R, Yoon J, Shi L, et al. **Inequality in America: The Contribution of Health Centres in Reducing and Eliminating Disparities in Access to Care.** Medical Care Research & Review, 2001. 58(2):234-48.

This article reviews the literature on the relationship between access to appropriate health care and reductions in health status disparities in the American context. The authors found that access to a regular and usual source of care alone can mitigate health status disparities. The safety net health centre network has reduced racial/ethnic, income, and insurance status disparities in access to primary care and important preventive screening procedures. In addition, the network has reduced low birth weight disparities for African American infants. The authors concluded that health centres are successful in reducing and eliminating health access disparities by establishing themselves as their patients' usual and regular source of care.

Gosden T, Forland F, Kristiansen I, et al. Capitation, Salary, **Fee-For-Service and Mixed Systems of Payment: Effects on The Behaviour of Primary Care Physicians**. Cochrane Database of Systematic Reviews 2000, Issue 3.

This review examined the impact of different payment systems on primary care physician behaviour. Three payment systems were included: capitation (payment is made for every patient for whom care is provided), salary, and fee for service (payment is made for every item of care provided). There was some evidence that primary care physicians provide a greater quantity of primary care services under fee for service payment compared with capitation and salary, although long-term effects are unclear. There was no evidence, concerning other important outcomes such as patient health status, or comparing the relative impact of salary versus capitation payment.

Currell R, Urquhart C, Wainwright P, Lewis R. **Telemedicine Versus Face To Face Patient Care: Effects on Professional Practice and Health Care Outcomes**. Cochrane Database of Systematic Reviews 2000, Issue 2.

Telemedicine is using telecommunications technology for medical diagnosis and health care. It includes transmitting test results down phone lines, using video technology for long distance consultations or education, and many other uses. The review found studies showing various forms of telemedicine are feasible, but there is not yet enough evidence to show the effects on health outcomes or costs of many expensive uses of technology. Overall, people self-monitoring at home or having video consultations were satisfied with their experience. More research is needed to assess the effects of the range of telemedicine techniques.

Lishner D, Richardson M, Levine P, et al. **Access to Primary Health Care Among Persons With Disabilities in Rural Areas: A Summary of the Literature**. The Journal of Rural Health, 1996. 12(1): 45-53.

Despite the prevalence of disabilities among persons living in rural areas, scarce data exists on their health care needs. While rural residents generally experience barriers to accessing primary health care, these problems are further exacerbated for people with disabilities. This article summarises findings from the published literature on access to primary health care among people with disabilities living in rural locations. A comprehensive computerised literature search identified 86 articles meeting the study criteria, focused on a number of rural populations affected by disabilities including children and adolescents. The literature consistently emphasises the failure of local health care systems in non-metropolitan areas to adequately address the complex medical and related needs of individuals with disabilities. In the absence of specialised expertise, facilities, and primary care providers trained specifically to care for disabled persons, local programmes rely heavily on the use of indigenous paraprofessionals and alternative models of care. Further research is needed to identify and test the efficacy of innovative service delivery strategies to improve health care access for this population.

Giuffrida A, Gosden T, Forland F, et al. **Target Payments in Primary Care: Effects on Professional Practice and Health Care Outcomes**. Cochrane Database of Systematic Reviews 1999, Issue 4.

This review looked at the effects of target payments on the behaviour of primary care physicians (e.g. general practitioners and family physicians). Under a target payments system a lump sum is paid to physicians who provide a certain quantity or level of care. Two studies assessed the impact of target payments on immunisation rates. There was some evidence that target payments resulted in an increase in immunisations by primary care physicians. However there was insufficient evidence to provide a clear answer as to whether target payments were an effective method of improving quality of care.

Yano E, Fink A, Hirsch S, et al. **Helping Practices Reach Primary Care Goals: Lessons From the Literature**. Archives of Internal Medicine, 1995. 155:1146-56.

This review summarises programmes to enhance the quality and economy of primary care. Of 1,785 articles identified, 32 (26 randomised trials) met the criteria. The authors found that such interventions (especially computer-generated reminders, audit and feedback, social-influence-based methods, and shifting specific function to non-physicians) show substantial improvements (>50% of studies were positive) in physician-ordered services, preventive care, management and coordination, use of services, efficiency, satisfaction, access, and shift from inpatient to outpatient settings. Interventions are less successful for improving continuity of care, morbidity, physical environment, mortality, humanistic process, costs and charges, physical function, and technical process.

Other Relevant Publications

Crampton P, Davis P, Lay-Yee R, et al. **Does Community-Governed Non-Profit Primary Care Improve Access to Services? Cross-Sectional Survey of Practice Characteristics**. International Journal of Health Services. 2005. 35:465-78.

This study compared community-governed non-profit and for-profit primary care practices in New Zealand to test two hypotheses: (1) nonprofits reduce financial and cultural barriers to access; and (2) nonprofits do not differ from for-profits in equipment, services, service planning, and quality management. Data were obtained from a nationally representative cross-sectional survey of GPs. Practices were categorised by ownership status: private community-governed non-profit or private for-profit. Community-governed nonprofits charged lower patient fees per visit and employed more Māori and Pacific Island staff, thus reducing financial and cultural barriers to access compared with for-profits. Nonprofits provided a different range of services and were less likely to have specific items of equipment; they were more likely to have written policies on quality management, complaints, and critical events, and to carry out locality service planning and community needs assessments. The findings support the shift to non-profit community governance occurring in NZ and elsewhere.

Wilson, H. **Co-Locating Primary Care Facilities within Emergency Departments: Brilliant Innovation or Unwelcome Intervention into Clinical Care?** New Zealand Medical Journal, 2005. 118(1221).

This article reviews the reasons for co-locating primary care facilities within emergency departments. These include overcrowding of ED, so-called 'inappropriate' attendees, and provision of 24-hour primary medical services for Dunedin City. While the proposal seems to have some intuitive merit, the author argues that the attribution of overcrowding in ED to attendance by GP-type patients is simplistic and it does not address how patients are processed within ED or how they are transferred to wards later if required ('access block'). This article also discusses some other unresolved issues including the implications of recent funding arrangements in primary care and risk management.

Denny S, Balhorn A, Lawrence A et al. **Student Access To Primary Health Care and Preventive Health Screening at a School-Based Health Centre In South** A**uckland, New Zealand**. New Zealand Medical Journal, 2005. 118:(1218).

This study considered where students usually access primary health care and compared the quality of preventive health services students who use the school-based health centre (SBHC) receive, to those who go elsewhere for health care. While most students (79%) access health care from their family doctor, a significant number (40%) attended SBHC in the last 12 months. Overall, health screening and preventive counselling from health care providers was low. Students who used SBHC were more likely to received private and confidential health care and preventive screening than students who go elsewhere. School-based health care provides additional access to care that does not appear to replace traditional family practice based health care. While the SBHC appears to deliver better quality preventive health services for adolescents compared to traditional primary health care, improvements are needed across all primary health care settings.

Respiratory and Infectious Diseases

Introduction to the Respiratory and Infectious Disease Section

Introduction

Research suggests that Pacific children experience higher hospital admission rates for acute respiratory infections, pneumonia and asthma / chronic obstructive pulmonary diseases than Māori or European children [174]. In addition, when hospitalised with conditions such as pneumonia, Pacific children often have more severe disease than European children [175]. In considering approaches to reducing the large burden of avoidable morbidity and mortality associated with infectious diseases however, a recent review of infectious disease control in New Zealand noted that while well organised government-run infectious disease programmes had eliminated several diseases in the past (e.g. *Brucella abortis*, hydatids), more recently infectious disease control had been mixed, with rates for many conditions associated with poverty and overcrowding (e.g. rheumatic fever, tuberculosis, gastroenteritis) remaining high by international standards [176]. Similarly, a recent review of paediatric respiratory disease noted the significant contribution poor housing, poverty, poor nutrition, access to primary, secondary and tertiary care, smoking and air pollution made to the burden of childhood respiratory and infectious diseases in this country [177].

Given the disproportionate burden these conditions place on the Pacific population, in this report they have been awarded a relatively high priority, with a range of indicators being explored in three main streams as follows:

1. **Upper Respiratory and Middle Ear Conditions**: Including *Acute Upper Respiratory Infections* (non-specific URTI, pharyngitis, tonsillitis and waiting list admissions for tonsillectomy) and *Middle Ear Conditions* (hearing screening at school entry, hospital admissions for otitis media and waiting list admissions for grommets).
2. **Lower Respiratory Tract Infections**: Including hospital admissions for *Bronchiolitis, Asthma, Pneumonia* and *Bronchiectasis*.
3. **Infectious Diseases**: Including *Immunisation and Vaccine Preventable Diseases,* and hospital admissions for *Meningococcal Disease, Tuberculosis, Rheumatic Fever, Serious Skin Infections* and *Gastroenteritis*.

While each of these conditions differs in terms of its distribution, risk factor profile and management, from a population health perspective they share a set of common determinants (e.g. housing, nutrition, exposure to second hand cigarette smoke, access to primary health care) and there is some merit in reviewing approaches to their prevention collectively. Thus, before considering each of these conditions in turn, this section uses data from the National Minimum Dataset, to provide a brief cross-sectional overview of infectious and respiratory disease admissions in Pacific children and young people, before considering a range of policy and evidence based review documents which explore population level approaches to address the underlying determinants of infectious and respiratory disease.

Data Sources and Methods

Definition

Hospital Admissions for Asthma and Respiratory and Infectious Diseases in Children & Young People 0-24 Years

Data Sources

Numerator: National Minimum Dataset: Hospital admissions for children and young people 0-24 years with a primary diagnosis in ICD-10 of:

Upper Respiratory Infections: Acute Nasopharyngitis (Common Cold J00); Acute Sinusitis (J01); Acute Pharyngitis (J02); Acute Tonsillitis (J03); Acute Laryngitis/Tracheitis (J04); Acute URTI Multiple/Unspecified Sites (J06); Croup (J05.0); Epiglottitis (J05.1); Chronic Tonsillitis (J35.0); Hypertrophy Tonsils/Adenoids (J35.1-J35.3), Other/Unspecified Chronic Diseases Tonsils/Adenoids (J35.8-J35.9), Peritonsillar Abscess (J36) and, Sleep Apnoea (G47.3).

Middle Ear and Mastoid Conditions: Otitis Media (H65-67); Eustachian Tube Disorders (H68-69); Mastoiditis and Related Disorders (H70); Cholesteatoma of the Middle Ear (H71); Perforation / Other Disorders of the Tympanic Membrane (H72-73); and Other Disorders of the Middle Ear/Mastoid (H74-75)).

Lower Respiratory Conditions: Bronchiolitis (J21); Asthma (J45-46); Bacterial / Viral Pneumonia (J12-J18, J10.0, J11.0); Bronchiectasis (J47); Acute Bronchitis (J20); Acute Unspecified Lower Respiratory Tract Infection (LRTI) (J22); Lung Abscesses/Pyothorax (J85-86).
Infectious Diseases: Infectious Gastroenteritis (A0-A09, R11); Serious Skin Infections (L00-L04, L050, L08); Tuberculosis (A15-A19); Meningococcal Disease (A39); Acute Rheumatic Fever (I00-I02); Rheumatic Heart Disease (I05-I09); Bacterial Meningitis (G00-G0Other/Unspecified Meningitis (G02-G03); Septic Arthritis (M00-M01); Osteomyelitis (M86).
Note: These codes were mapped to ICD-9 for time series analysis.
Denominator: NZ Census

Notes on Interpretation
Note 1*: Appendix 4: The National Minimum Dataset* outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data. In addition trend graphs and cross sectional tables may differ slightly, as time series analyses utilise ICD-9 coding (in order to ensure continuity), while cross sectional tables utilise ICD-10 (Note: while a 1:1 mapping between ICD-9 and ICD-10 exists for most respiratory and infectious diseases, ICD-10 includes "J22 Acute Unspecified LRTI", which is not present in ICD-9). Finally, the coding for serious skin infections and gastroenteritis in this section differs slightly from that used for ASH admissions (see individual sections for details).
Note 2: Tests of statistical significance have not been applied to the data in this section, and thus any associations described do not imply statistical significance or non-significance.

Indicator Category
Admissions: Proxy B-C

New Zealand Distribution

Any and Sole Pacific: During 2003-2007, lower respiratory tract infections made the largest collective contribution to hospital admissions for infectious and respiratory disease amongst Any and Sole Pacific children and young people. In terms of individual conditions, bronchiolitis, followed by asthma > bacterial / viral pneumonia > serious skin infections > infectious gastroenteritis made the largest contributions for Any Pacific children and young people, while bronchiolitis, followed by bacterial / viral pneumonia > asthma > serious skin infections > infectious gastroenteritis made the largest contributions for Sole Pacific children and young people. In addition, overall admission rates in each of the three main categories where higher for Sole Pacific > Any Pacific > Total New Zealand children and young people during this period (**Table 29**).

New Zealand: For New Zealand children and young people during 2003-2007, lower respiratory tract infections also made the largest collective contribution to hospital admissions for infectious and respiratory disease, although in terms of individual conditions, infectious gastroenteritis followed by asthma > bronchiolitis > serious skin infections > bacterial / viral pneumonia > acute unspecified URTIs all made substantial contributions (**Table 30**).

Table 29. Acute and Arranged Hospital Admissions for Asthma, Respiratory and Infectious Diseases in Pacific Children & Young People 0-24 Yrs by Diagnosis, New Zealand 2003-2007

Diagnosis	Any Pacific				Sole Pacific			
	Number: Total 2003-07	Number: Annual Average	Rate per 1,000	% of Total	Number: Total 2003-07	Number: Annual Average	Rate per 1,000	% of Total
Upper Respiratory and Middle Ear Infections								
Acute URTI Unspecified	2,608	521.6	3.59	57.0	1,989	397.8	5.01	57.7
Croup/Acute Laryngitis/Tracheitis	606	121.2	0.83	13.2	467	93.4	1.18	13.6
Otitis Media	508	101.6	0.70	11.1	339	67.8	0.85	9.8
Acute Tonsillitis	449	89.8	0.62	9.8	345	69.0	0.87	10.0
Acute Pharyngitis	213	42.6	0.29	4.7	163	32.6	0.41	4.7
Peritonsillar Abscess	86	17.2	0.12	1.9	68	13.6	0.17	2.0
Mastoiditis and Related Disorders	35	7.0	0.05	0.8	28	5.6	0.07	0.8
Other URTI	56	11.2	0.08	1.2	37	7.4	0.09	1.1
Other Middle Ear Disorders	15	3.0	0.02	0.3	9	1.8	0.02	0.3
Total	4,576	915.2	6.30	100.0	3,445	689.0	8.68	100.0
Lower Respiratory Conditions								
Bronchiolitis	6,372	1274.4	8.77	33.9	5,026	1005.2	12.66	34.5
Asthma	5,697	1139.4	7.84	30.3	4,157	831.4	10.47	28.5
Bacterial/Viral Pneumonia	5,337	1067.4	7.35	28.4	4,322	864.4	10.89	29.6
Acute Unspecified LRTI	785	157.0	1.08	4.2	605	121.0	1.52	4.2
Bronchiectasis	338	67.6	0.47	1.8	274	54.8	0.69	1.9
Pertussis	115	23.0	0.16	0.6	92	18.4	0.23	0.6
Acute Bronchitis	98	19.6	0.13	0.5	67	13.4	0.17	0.5
Lung Abscesses/Pyothorax	39	7.8	0.05	0.2	34	6.8	0.09	0.2
Total	18,781	3,756.2	25.85	100.0	14,577	2,915.4	36.73	100.0
Infectious Diseases								
Serious Skin Infections	4,596	919.2	6.33	47.9	3,582	716.4	9.02	48.1
Infectious Gastroenteritis	3,622	724.4	4.99	37.7	2,707	541.4	6.82	36.4
Acute Rheumatic Fever	365	73.0	0.50	3.8	306	61.2	0.77	4.1
Meningococcal Disease	328	65.6	0.45	3.4	269	53.8	0.68	3.6
Osteomyelitis	232	46.4	0.32	2.4	190	38.0	0.48	2.6
Septic Arthritis	134	26.8	0.18	1.4	102	20.4	0.26	1.4
Tuberculosis	114	22.8	0.16	1.2	109	21.8	0.27	1.5
Rheumatic Heart Disease	83	16.6	0.11	0.9	77	15.4	0.19	1.0
Bacterial Meningitis	79	15.8	0.11	0.8	63	12.6	0.16	0.8
Other/Unspecified Meningitis	52	10.4	0.07	0.5	41	8.2	0.10	0.6
Total	9,605	1,921.0	13.22	100.0	7,446	1,489.2	18.76	100.0

Source: Numerator - National Minimum Dataset; Denominator – Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Other URTI includes Acute Sinusitis, Acute Nasopharyngitis & Epiglottis &Other/Unspecified Chronic Diseases Tonsils/Adenoids. Other Middle Ear Disorders includes Eustachian tube disorders, Mastoiditis and Related Disorders, Perforation / Other Disorders Tympanic Membrane, Other Disorders Middle Ear/Mastoid and Cholesteatoma Middle Ear

Table 30. Acute and Arranged Hospital Admissions for Asthma and Respiratory and Infectious Diseases in Children and Young People 0-24 Years by Diagnosis, New Zealand 2003-2007

Diagnosis	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	% of Total
Upper Respiratory and Middle Ear Infections				
Acute URTI Unspecified	16,287	3,257.4	2.29	46.3
Croup/Acute Laryngitis/Tracheitis	5,287	1,057.4	0.74	15.0
Acute Tonsillitis	5,021	1,004.2	0.71	14.3
Otitis Media	3,974	794.8	0.56	11.3
Acute Pharyngitis	2,110	422.0	0.30	6.0
Peritonsillar Abscess	1,206	241.2	0.17	3.4
Chronic Tonsillitis	483	96.6	0.07	1.4
Other URTI	451	90.2	0.06	1.3
Other Middle Ear Disorders	384	76.8	0.05	1.1
Total	35,203	7,040.6	4.95	100.0
Lower Respiratory Conditions				
Asthma	27,350	5,470.0	3.85	36.2
Bronchiolitis	22,876	4,575.2	3.22	30.2
Bacterial/Viral Pneumonia	18,518	3,703.6	2.61	24.5
Acute Unspecified LRTI	4,419	883.8	0.62	5.8
Bronchiectasis	903	180.6	0.13	1.2
Acute Bronchitis	837	167.4	0.12	1.1
Pertussis	572	114.4	0.08	0.8
Lung Abscesses/Pyothorax	155	31.0	0.02	0.2
Total	75,630	15,126.0	10.64	100.0
Infectious Diseases				
Infectious Gastroenteritis	27,613	5,522.6	3.88	49.7
Serious Skin Infections	22,445	4,489.0	3.16	40.4
Osteomyelitis	1,375	275.0	0.19	2.5
Meningococcal Disease	1,270	254.0	0.18	2.3
Acute Rheumatic Fever	881	176.2	0.12	1.6
Septic Arthritis	712	142.4	0.10	1.3
Tuberculosis	436	87.2	0.06	0.8
Bacterial Meningitis	370	74.0	0.05	0.7
Other/Unspecified Meningitis	328	65.6	0.05	0.6
Rheumatic Heart Disease	153	30.6	0.02	0.3
Total	55,583	11,116.6	7.82	100.0

Source: Numerator - National Minimum Dataset; Denominator - Census. Note: Other URTI includes Acute Sinusitis, Acute Nasopharyngitis & Epiglottis &Other/Unspecified Chronic Diseases Tonsils/Adenoids. Other Middle Ear Disorders includes Eustachian tube disorders, Mastoiditis and Related Disorders, Perforation / Other Disorders Tympanic Membrane, Other Disorders Middle Ear/Mastoid and Cholesteatoma Middle Ear

Policy Documents and Evidence Based Reviews Relevant to the Prevention of Respiratory and Infectious Disease

Given their multi-factorial aetiology (e.g. exposure to infectious agents, cigarette smoke, poor nutrition, sub-standard housing, overcrowding), approaches to the prevention of infectious and respiratory diseases take a variety of forms. The following tables review local policy documents and evidence based reviews which consider approaches to the prevention of infectious and respiratory diseases under the following sub-headings:

1. **Generic Approaches to Infectious and Respiratory Disease:** A range of local policy documents and evidence based reviews consider approaches to infectious and respiratory diseases in general, and these are briefly summarised in **Table 31**.
2. **Smoking** is a well known risk factor for respiratory and infectious diseases. **Table 32** considers local policy documents and evidence based reviews which explore population and individual level approaches to smoking and tobacco control.
3. **Housing and Household Crowding** [178, 179] are also well recognised upstream determinants of respiratory and infectious disease. **Table 33** summarises a limited number of documents which consider approaches to improving housing at the population level
4. **Breastfeeding** confers significant protection against respiratory and infectious disease and interventions aimed at increasing its uptake are reviewed in the **Breastfeeding Section** commencing on **Page 58**
5. **Immunisation** also confers protection against a number of specific respiratory and infectious diseases and interventions aimed at increasing its coverage are reviewed in the **Immunisation Coverage Section** commencing on **Page 193**
6. Interventions aimed at **Specific Respiratory and Infectious Diseases** are also considered in the following sections: **Acute Upper Respiratory Infections** (Pg 125), **Otitis Media** (Pg 145), **Bronchiolitis** (Pg 159), **Asthma** (Pg 167), **Pneumonia** (Pg 175), **Bronchiectasis** (Pg 182), **Meningococcal Disease** (Pg 206), **Tuberculosis** (Pg 213), **Rheumatic Fever** (Pg 221), **Serious Skin Infections** (Pg 230), **Gastroenteritis** (Pg 238).

Table 31. Local Policy Documents and Evidence Based Reviews Which Consider Generic Approaches to Infectious and Respiratory Disease

Ministry of Health Policy Documents
Ministry of Health. **An Integrated Approach to Infectious Disease, Priorities for Action 2002-2006**. 2001, Ministry of Health: Wellington. This document addresses the NZ Health Strategy's objective of reducing the incidence and impact of infectious diseases. It presents a framework which assigns infectious diseases to different categories, with vaccine preventable, respiratory and sexually transmitted diseases being identified as high priority areas. A range of strategies are outlined with relevance at central government and the DHB / PHO level.
Ministry of Health, **Communicable Disease Control Manual**. Public Health Group, Editor. 1998, Ministry of Health. The Communicable Disease Control Manual was developed to provide information on the prevention and control of communicable diseases in New Zealand. It includes national protocols, with the diseases covered being divided into vaccine-preventable, food-or waterborne, rare diseases, and other notifiable diseases. (Note: the manual is currently being reviewed and a new edition is expected in the near future).
Other Relevant Publications
Jefferson T, Foxlee R, Del Mar C, et al. **Interventions for the Interruption or Reduction of the Spread of Respiratory Viruses**. Cochrane Database of Systematic Reviews 2007, Issue 4. The effectiveness of interventions to interrupt or reduce the spread of respiratory viruses (excluding vaccines and antiviral drugs) was explored. The authors concluded that respiratory virus spread might be prevented by hygiene measures which might reduce transmission from children to other household members. Implementing barriers to transmission, isolation, and hygiene measures may contain respiratory virus epidemics. The authors found limited evidence that (more uncomfortable and expensive) N95 masks were superior to simple ones. Adding virucidals or antiseptics to normal hand washing is of uncertain benefit.

The Asthma and Respiratory Foundation of New Zealand. **Trying to Catch Our Breath: The Burden of Preventable Breathing Diseases in Children and Young People**, 2006. I. Asher and C. Byrnes, Editors. 2006: Wellington. This document reviews a range of respiratory conditions of importance to children and highlights the significant contribution poor housing, poverty, poor nutrition, issues with access to primary, secondary and tertiary care, smoking and air pollution make to the burden of paediatric respiratory disease in New Zealand. The report also makes a number of recommendations for DHBs including the need to develop; appropriate indicators of child and youth respiratory health; strategies to reduce rates of respiratory disease; specific strategies for Māori and Pacific children and young people; Māori workforce capability; strategies to improve nutrition; a systems approach to identifying smoking/smoke exposure in patients; improved smoking cessation programmes for parents and adults; increased awareness of key respiratory symptoms; and to implement best practice evidence based guidelines.

Table 32. Local Policy Documents and Evidence Based Reviews Aimed at Smoking / Tobacco Control

Ministry of Health Policy Documents
Minister of Health. **Health Targets: Moving Towards Healthier Futures 2007/2008**. 2007, Ministry of Health. Wellington http://www.MOH.govt.nz/MOH.nsf/pagesmh/6635/$File/health-targets-aug07.pdf Reducing tobacco related harm has been identified as one of the Ministry of Health's new Health Targets, with DHBs being required to make tobacco control a priority and to deliver a tobacco control plan for their region. Other initiatives include the introduction of pictorial warnings on tobacco packets, ongoing social marketing around smokefree homes and cars, and the strengthening existing activities including Quitline, pregnancy services, and improving access to subsidised nicotine replacement therapy.
Ministry of Health. **Clearing the Smoke: A Five Year Plan for Tobacco Control in New Zealand (2004-2009)**. 2004, Ministry of Health; Wellington. This document outlines a vision of smoke free lifestyles being the norm in New Zealand, with one of the goals being to reduce inequalities in health outcomes. A number of objectives are outlined: preventing smoking initiation; promoting smoking cessation; preventing harm to non-smokers from second hand smoke.
Ministry of Health. **Child and Youth Health Toolkit.** 2004, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/pagesmh/5411/$File/childandyouthhealthtoolkit.pdf This toolkit is aimed at DHB funders and planners, doctors, nurses, managers, PHOs, community providers, DHB boards, and other individuals and groups wanting to improve child and youth health. Chapter 9, pg (39-44), focuses on tobacco control and outlines what needs to be done in order to decrease exposure of children to second hand smoke, as well as preventing the uptake of smoking by young people.
Systematic and Other Reviews from the International Literature
Guidance on Preventing the Uptake of Smoking by Children and Young People. 2008, National Institute for Health and Clinical Excellence: London. http://www.nice.org.uk/nicemedia/pdf/PH14fullguidance.pdf This guideline focuses on mass media and point of sale measures that can be used to stop children and young people from taking up smoking. The document makes a number of recommendations with respect to campaign development, campaign messages, campaign strategies and illegal sales.
National Institute for Health and Clinical Excellence. **Smoking Cessation Services for Primary Care, Pharmacies, Local Authorities and Workplaces Particularly for Manual Working Groups, Pregnant Women And Hard To Reach Communities.** National Institute for Health and Clinical Excellence, 2008, London. http://www.nice.org.uk/nicemedia/pdf/PH010guidance.pdf This document makes a number of recommendations for smoking cessation services based on review of the literature. A number of approaches are considered including brief interventions, individual counselling, group counselling, pharmacotherapy, self help materials, telephone counselling, quitlines, and mass media.
Thomas R, Baker P, Lorenzetti D. **Family-Based Programmes for Preventing Smoking by Children and Adolescents.** Cochrane Database of Systematic Reviews 2007, Issue 1. Children and adolescents' likelihood of starting smoking is influenced by the behaviour of their families. This review assessed the effectiveness of interventions aimed at helping family members strengthen non-smoking attitudes and promote non-smoking in children and adolescents. It noted that some high quality studies showed that family interventions helped prevent adolescent smoking, but that less well-conducted trials had mostly neutral or negative findings. The quality of staff training and programme delivery may be related to effectiveness, but the number of sessions in the programme did not make a difference.

Thomas R, Perera R. **School-Based Programmes for Preventing Smoking**. Cochrane Database of Systematic Reviews, 2006. Issue 3. The review identified 23 high quality randomised controlled trials of school-based programmes to prevent children becoming smokers, with interventions including information-giving, social influence approaches, social skills training, and community interventions. The review found little strong evidence that school-based programmes were effective in the long term in preventing smoking uptake. The majority of studies drew on a social influences intervention and although half of the best quality studies in this group found short-term effects on children's smoking behaviour, the highest quality and longest trial found no long-term effects from 65 lessons over eight years. There was little evidence that information alone was effective and limited evidence for the effects of interventions aimed at developing generic social competence, or with a multi-modal approach that included community initiatives.
Thomson G, Wilson N, Howden-Chapman P. **Population Level Policy Options for Increasing the Prevalence of Smokefree Homes.** Journal of Epidemiology & Community Health, 2006. 60(4):298-304. This review aimed to identify and evaluate options for government policies to increase the prevalence of smokefree homes. Evidence of the effectiveness of such programmes in altering the prevalence of, and inequalities in, smokefree homes is limited, with the review not finding any published evidence on the cost effectiveness of such programmes. The authors noted that within comprehensive programmes, there is indirect evidence that some mass media campaigns could increase the prevalence of smokefree homes. Structural options also included smokefree places legislation and laws for the protection of children. The authors concluded that comprehensive tobacco control programmes (to reduce the prevalence of smoking in the total population) were likely to be the most effective and sustainable option for increasing the prevalence of smokefree homes.
Prokhorov A, Winickoff J, Ahluwalia J, et al. Tobacco Consortium, American Academy of Pediatrics Center for Child Health Research. **Youth Tobacco Use: A Global Perspective for Child Health Care Clinicians**. Pediatrics, 2006. 118(3):e890-903. This article reviews contemporary evidence on the aetiology of nicotine dependence among youth, the forms of youth tobacco products worldwide, global youth tobacco-control efforts to date, medical education efforts, and the role of health professionals in youth tobacco-control. The authors also review currently available funding opportunities for the development and implementation of youth tobacco-control programmes.
Stead L, Lancaster T. **Interventions for Preventing Tobacco Sales to Minors**. Cochrane Database of Systematic Reviews, 2005. Issue 1. This review assessed the effects of interventions to reduce underage access to tobacco by deterring shopkeepers from making illegal sales. The authors concluded that interventions with retailers can lead to large decreases in the number of outlets selling tobacco to youths, but that few of the communities studied achieved sustained levels of high compliance. Thus there was limited evidence that such interventions changed youth perceptions of ease of access to tobacco, or smoking behaviour.
Roseby R, Waters E, Polnay A, et al. **Family and Carer Smoking Control Programmes for Reducing Children's Exposure to Environmental Tobacco Smoke**. Cochrane Database of Systematic Reviews, 2002. Issue 3. This review found that there is currently insufficient evidence to show which interventions are most effective for decreasing parental smoking and preventing exposure to tobacco smoke in childhood. Although several interventions, including parental education and counselling programmes, have been used to try to reduce children's smoke exposure, their effectiveness has been unclear, with insufficient evidence for one intervention reducing parental smoking (and hence child exposure), being more effective than others. Brief counselling may help in some settings, with limited evidence for intensive counselling.

Table 33. Local Policy Documents and Evidence Based Reviews Aimed at Housing

New Zealand Policy Documents
Housing New Zealand Corporation. **Building the Future: The New Zealand Housing Strategy.** 2005, Housing New Zealand Corporation: Wellington http://www.hnzc.co.nz/hnzc/dms/380D2C40C069A4CE4665F55A8C4523D1.pdf The NZ Housing Strategy sets out a vision and strategic direction for housing in New Zealand up to 2015. It describes a collaborative approach to strengthening the housing sector's ability to provide affordable, quality housing for all New Zealanders. The strategy identifies 7 action areas which include improving housing assistance and affordability; and improving housing quality. The government is identified as having a role to play in encouraging quality houses by regulating housing quality, establishing housing standards and providing guidance through using best practice in its own work.

Systematic and Other Reviews from the International Literature
Taske N, Taylor L, Mulvihill C, Doyle N. **Housing And Public Health: A Review of Reviews of Interventions for Improving Health - Evidence Briefing.** 2005, Health Development Authority. http://www.nice.org.uk/nicemedia/pdf/housing_MAIN%20FINAL.pdf This briefing aims to identify all relevant evidence based review documents on public health interventions relating to housing; review these papers and highlight what housing-related interventions work to promote health for all population groups, but with particular reference to disadvantaged and vulnerable groups; Identify cost-effectiveness data for housing-related interventions to promote health for all population groups; highlight any gaps in the evidence and provide recommendations for future research. This UK focused briefing paper is intended to inform policy and decision makers, housing officials, public health physicians and other public health practitioners in the widest sense.
Other Relevant Publications
Housing New Zealand Corporation. **Healthy Housing Programme**. Housing New Zealand Corporation. Wellington. http://www.hnzc.co.nz/hnzc/web/housing-improvements-&-development/property-improvement/healthy-housing.htm. Healthy Housing is a joint project between Housing NZ and DHBs that began in 2001. The programme works with Housing NZ tenants in selected areas and aims to raise awareness of infectious diseases; to improve access to health and social services; to reduce the risk of housing-related health problems and; to reduce overcrowding. The preliminary analysis of a case counterfactual study looking at acute hospitalisations of those involved in the Healthy Housing Programme found a decrease in potentially avoidable hospitalisations and housing related potentially avoidable hospitalisations[180].
Howden-Chapman P, Matheson A, Crane J, et al. **Effect of Insulating Existing Houses on Health Inequality: Cluster Randomised Study in the Community**. British Medical Journal, 2007. 334(7591):460 This community based, cluster, single blinded randomised study aimed to determine whether insulating existing houses increased indoor temperatures and improved occupants' health and wellbeing. The study found that insulating existing houses led to a significantly warmer, drier indoor environment and resulted in improved self rated health, self reported wheezing, days off school and work, and visits to general practitioners as well as a trend for fewer hospital admissions for respiratory conditions.
Chaudhuri N. **Interventions to Improve Children's Health by Improving the Housing Environment**. Reviews on Environmental Health, 2004. 19(3-4):197-222. This paper reviews several factors that have been shown to mediate housing and health relations, including psychosocial, environmental, socioeconomic, behaviour-cultural, and physiological factors, and provides examples of interventions to improve child health, with housing as a focus. Examples include integrated energy-efficiency programmes to improve thermal comfort and to reduce the presence of allergens like mould and dust mites, housing and health policies, regulation and standard setting, education and training.

Upper Respiratory Tract Infections

Å Acute Upper Respiratory Infections and Tonsillectomy in Children

Upper respiratory tract infections (URTIs) are a common cause of illness in childhood and account for a large number of visits to primary care each year [181]. In New Zealand, a number of acute URTIs are considered ambulatory sensitive (Å), on the basis that early and appropriate management in primary care will significantly reduce the need for hospital admission. In children, these conditions include:

J00 Acute Nasopharyngitis (Common Cold)
J01 Acute Sinusitis
J02 Acute Pharyngitis
J03 Acute Tonsillitis
J04 Acute Laryngitis and Tracheitis
J06 Acute Upper Respiratory Infections of Multiple and Unspecified Sites

While at first glance it may appear that 100% of such admissions should be avoidable, given early access to primary care, it must be remembered that in hospital admission data, the primary diagnosis is usually assigned at the time of discharge. Thus for the acutely unwell child, such a diagnosis may have been arrived at only after a number of investigations (e.g. lumbar puncture, chest x-ray) have ruled out more serious causes of illness. Thus, URTI admissions in this age group likely reflect a mixture including those which might have been avoided given early access to primary care, as well as those requiring a fuller diagnostic work up than available in the primary care setting.

While generally being of short duration and limited in their severity, URTIs place a significant burden on secondary care services, with the URTIs most frequently causing hospital admission in children being outlined briefly below:

Å **Non Specific URTIs (J00 J06)**: Non specific URTIs produce a variety of symptoms including cough, sore throat, runny nose, fever and malaise. They are usually viral in origin, with less than 10% of cases being caused by bacteria [181]. For this group, the available evidence would suggest that antibiotic treatment does not alter the course of disease, with these conditions being self limiting in the vast majority of instances [181].

Å **Acute Pharyngitis and Tonsillitis (J02 J03):** While the majority of cases of pharyngitis and tonsillitis are also viral in origin, self limiting and require only symptomatic treatment (e.g. pain relief), a small number may be due to group A streptococcus, which if untreated may result in acute rheumatic fever [182]. The NZ Rheumatic Fever Guideline [183] thus recommends scoring all patients presenting with sore throat against a set of predetermined criteria (*Risk Factors*: Māori or Pacific ethnicity; 3-45 years of age; lower socioeconomic areas of the North Island; past history of acute rheumatic fever; *Clinical Criteria*: temperature >38°C, no cough, swollen tender lymph nodes, tonsillar swelling or exudate, age 3-14 years) and on the basis of these criteria, dividing patients into 3 groups: high risk (where a throat swab should be taken and empiric antibiotics commenced), medium risk (where a throat swab should be taken and antibiotics commenced if the swab is positive) and low risk (where no throat swab is taken and treatment is symptomatic only) [183].

Non-Å **Waiting List Admissions for Tonsillectomy (+/- Adenoidectomy)**: In New Zealand, a large number of waiting list admissions for tonsillectomy (+/- adenoidectomy) occur each year. While a number are indicated for the management of upper airway obstruction / obstructive sleep apnoea, the vast majority are for the management of recurrent tonsillitis. In this context, while the only Cochrane Review in this area found that there was insufficient research to determine whether tonsillectomy was superior to non-surgical treatment for children with recurrent tonsillitis [184], a recently released Australasian position paper [185] suggested that tonsillectomy (+/- adenoidectomy) was of benefit for recurrent acute tonsillitis (e.g. 7 episodes in the past 12 months / 5 per year for 24 months / 3 per year for 3 years) but

that the clinical severity of the episodes also needed to be taken into account (e.g. time off school, spread of infection to siblings, disruption to parent's work). The authors also noted that the procedure was not without its risks, with tonsillar bed haemorrhage being the most frequent complication reported [185].

The following section uses data from the National Minimum Dataset to review acute / arranged admissions for acute upper respiratory infections in Pacific children aged 0-14 years, as well as waiting list admissions for tonsillectomy (+/- adenoidectomy). Policy and evidence based review documents which consider how these conditions might best be prevented / managed are considered at the end of this section.

Data Sources and Methods

Definition

1. Acute/Arranged Hospital Admissions for Acute Upper Respiratory Tract Infections in Children (0-14 years)
2. Waiting List Admissions for Tonsillectomy (+/-Adenoidectomy) in Children (0-14 years)

Data Source

1. Acute/Arranged Hospital Admissions for Acute Upper Respiratory Tract Infections in Children (0-14 years)

Numerator: National Minimum Dataset: Acute/Arranged admissions in children (0-14 years) with a primary ICD-10 diagnosis of *Acute Upper Respiratory Infection*: Acute Nasopharyngitis (Common Cold J00); Acute Sinusitis (J01); Acute Pharyngitis (J02); Acute Tonsillitis (J03); Acute Laryngitis/Tracheitis (J04); Croup (J05.0); Epiglottitis (J05.1), Acute URTI Multiple/Unspecified Sites (J06).

Denominator: NZ Census

2. Waiting List Admissions for Tonsillectomy (+/-Adenoidectomy) in Children (0-14 years)

Numerator: National Minimum Dataset: Waiting List Admissions for Tonsillectomy +/- Adenoidectomy (ICD-10 Primary Procedure Code 4178900 or 4178901) in children (0-14 years). ICD-10 Indications for tonsillectomy include: Chronic Tonsillitis (J35.0), Hypertrophy Tonsils/Adenoids (J35.1-J35.3) and Sleep Apnoea (G47.3).

Denominator: NZ Census

Notes on Interpretation

Note 1*:* Croup and epiglottitis are considered non-ambulatory sensitive, as hospital admission may be required even for those presenting early in primary care. Overlaps in the coding of croup and acute laryngitis / tracheitis in the National Minimum Dataset resulted in these diagnoses being grouped together in order to ensure consistency.

Note 2: *Appendix 4: The National Minimum Dataset* outlines the limitations of the data used. The reader is urged to review the contents of this Appendix before interpreting any trends based on hospital admission data.

Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category

Admissions: Proxy B-C

Admissions for Acute Upper Respiratory Infections

New Zealand Distribution and Trends

Distribution by Primary Diagnosis

In New Zealand during 2003-2007, acute unspecified upper respiratory tract infections were the most frequent cause of acute upper respiratory tract infection (URTI) admissions in Any and Sole Pacific children, followed by croup / acute laryngitis / tracheitis. During this period, acute URTI admissions were highest for Sole Pacific > Any Pacific > Total New Zealand children (**Table 34**).

New Zealand Trends

In New Zealand during 1990-2007, while there were some year to year variations, admission rates for acute URTIs (excluding croup), were remarkably similar at the beginning and end of the period. Admissions for croup / laryngitis / tracheitis declined gradually during the mid-late 1990s / early 2000s (**Figure 35**).

New Zealand Distribution by Age and Cause

In New Zealand during 2003-2007, acute URTI admissions (excluding croup) were highest amongst infants <1 year, with rates declining progressively with increasing age. In contrast, croup / laryngitis / tracheitis admissions were highest amongst children between 1-2 years of age, with rates again declining as age increased (**Figure 36**).

Table 34. Acute / Arranged Hospital Admissions for Acute Upper Respiratory Infections by Diagnosis, Any and Sole Pacific vs. New Zealand Children 0-14 Years, 2003-2007

Primary Diagnosis	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	% of Total
Any Pacific				
Å Acute Unspecified URTI	2,486	497.2	5.06	70.6
Croup/Acute Laryngitis/Tracheitis	601	120.2	1.22	17.1
Å Acute Tonsillitis	248	49.6	0.50	7.0
Å Acute Pharyngitis	156	31.2	0.32	4.4
Å Acute Nasopharyngitis (Cold)	21	4.2	0.04	0.6
Å Acute Sinusitis	10	2.0	0.02	0.3
Total	3,522	704.4	7.17	100.0
Sole Pacific				
Å Acute Unspecified URTI	1,900	380.0	7.56	70.4
Croup/Acute Laryngitis/Tracheitis	462	92.4	1.84	17.1
Å Acute Tonsillitis	194	38.8	0.77	7.2
Å Acute Pharyngitis	122	24.4	0.49	4.5
Å Acute Nasopharyngitis (Cold)	14	2.8	0.06	0.5
Å Acute Sinusitis	5	1.0	0.02	0.2
Total	2,697	539.4	10.73	100.0
New Zealand				
Å Acute Unspecified URTI	15,369	3,073.8	3.56	61.4
Croup/Acute Laryngitis/Tracheitis	5,228	1,045.6	1.21	20.9
Å Acute Tonsillitis	2,615	523.0	0.61	10.4
Å Acute Pharyngitis	1,509	301.8	0.35	6.0
Å Acute Nasopharyngitis (Cold)	170	34.0	0.04	0.7
Å Acute Sinusitis	121	24.2	0.03	0.5
Acute Epiglottitis	14	2.8	0.00	0.1
Total	25,026	5,005.2	5.80	100.0

Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions only); Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Å: Denotes Category is included in the Ambulatory Sensitive Hospitalisation coding algorithm.

NZ Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

In New Zealand during 2003-2007, croup / laryngitis / tracheitis admissions were *significantly higher* for Pacific children (than for European or Asian children), males and those living in more deprived or urban areas (**Table 35**). Similarly acute URTI admissions (excluding croup) were *significantly higher* for Pacific > Māori > European > Asian children, males and those living in more deprived or urban areas (**Table 36**).

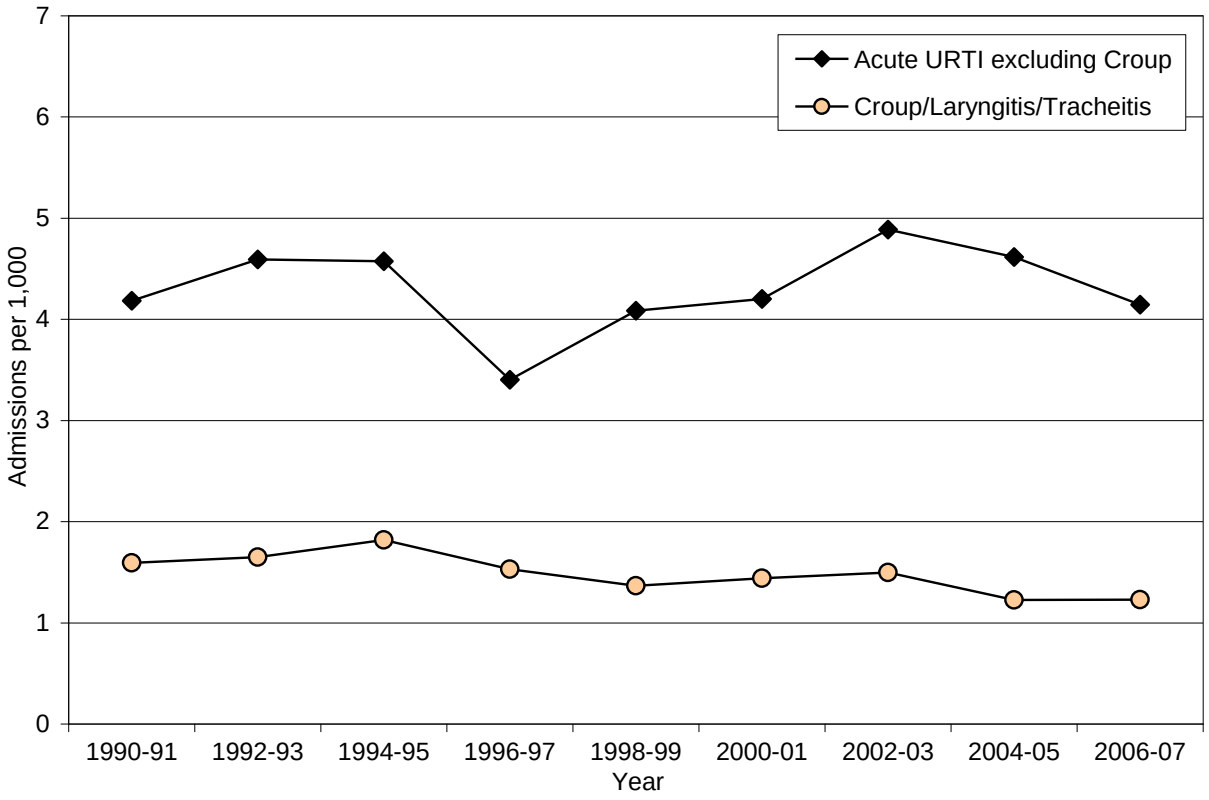
New Zealand Ethnic Specific Trends

When croup / laryngitis / tracheitis rates were reviewed for 1996-2007, ethnic differences were not marked, with the very modest excess in admissions amongst Pacific children only being evident during 2002-2007 (**Figure 37**). In contrast, ethnic differences in admissions for acute URTIs (excluding croup) were more marked, with rates being higher for Pacific > Māori > European > Asian children for the majority of this period (**Figure 38**). For both outcomes, admissions were higher for Sole Pacific than for Any Pacific children.

New Zealand Distribution by Season

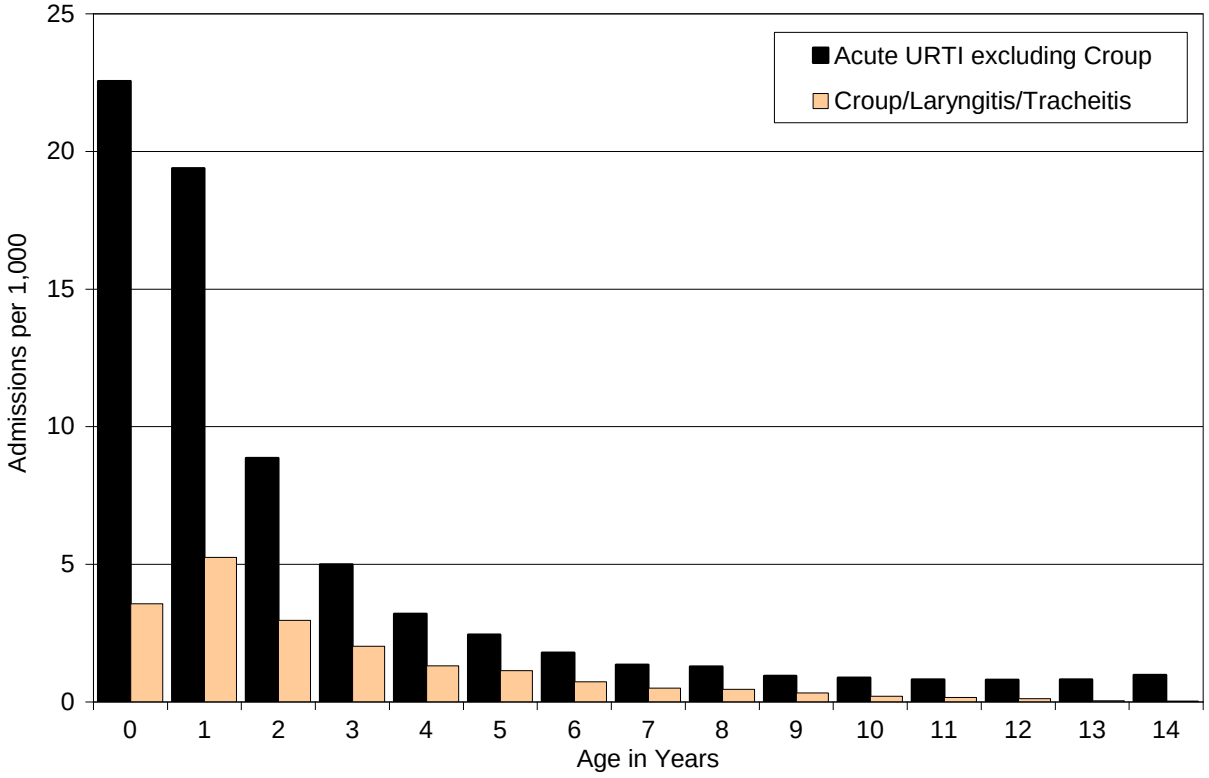
In New Zealand during 2003-2007, admissions for acute URTIs and croup / laryngitis / tracheitis both peaked during the winter months, with the lowest number of admissions being seen in summer (**Figure 39**).

Figure 35. Acute and Arranged Hospital Admissions for Acute Upper Respiratory Infections in Children 0-14 Years by Diagnosis, New Zealand 1990-2007



Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only); Denominator-Census. Note: Acute URTI includes Acute unspecified URTI, tonsillitis, pharyngitis, sinusitis, nasopharyngitis (cold) and epiglottitis.

Figure 36. Acute and Arranged Hospital Admissions for Acute Upper Respiratory Infections by Age in Children 0-14 Years, New Zealand 2003-2007



Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only); Denominator-Census; Acute URTI includes Acute unspecified URTI, tonsillitis, pharyngitis, sinusitis, nasopharyngitis (cold) and epiglottitis

Table 35. Risk Factors for Acute and Arranged Hospital Admissions for Croup / Laryngitis / Tracheitis in Children 0-14 yrs, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	0.81	1.00		1-2	0.83	1.00	
2	0.85	1.04	0.90 - 1.21	3-4	1.01	1.22	1.10 - 1.34
3	0.93	1.15	0.99 - 1.32	5-6	1.14	1.37	1.24 - 1.51
4	1.09	1.34	1.16 - 1.54	7-8	1.47	1.78	1.62 - 1.95
5	1.01	1.25	1.08 - 1.44	9-10	1.52	1.83	1.68 - 2.00
6	1.26	1.55	1.36 - 1.78	Prioritised Ethnicity			
7	1.37	1.69	1.48 - 1.93	European	1.30	1.00	
8	1.57	1.93	1.70 - 2.19	Māori	1.25	0.96	0.90 - 1.02
9	1.63	2.00	1.77 - 2.27	Pacific	1.44	1.11	1.01 - 1.22
10	1.43	1.76	1.55 - 1.99	Asian	0.50	0.39	0.33 - 0.45
Gender				Urban / Rural			
Female	0.78	1.00		Urban	1.27	1.00	
Male	1.62	2.06	1.94 - 2.19	Rural	0.88	0.69	0.64-0.75

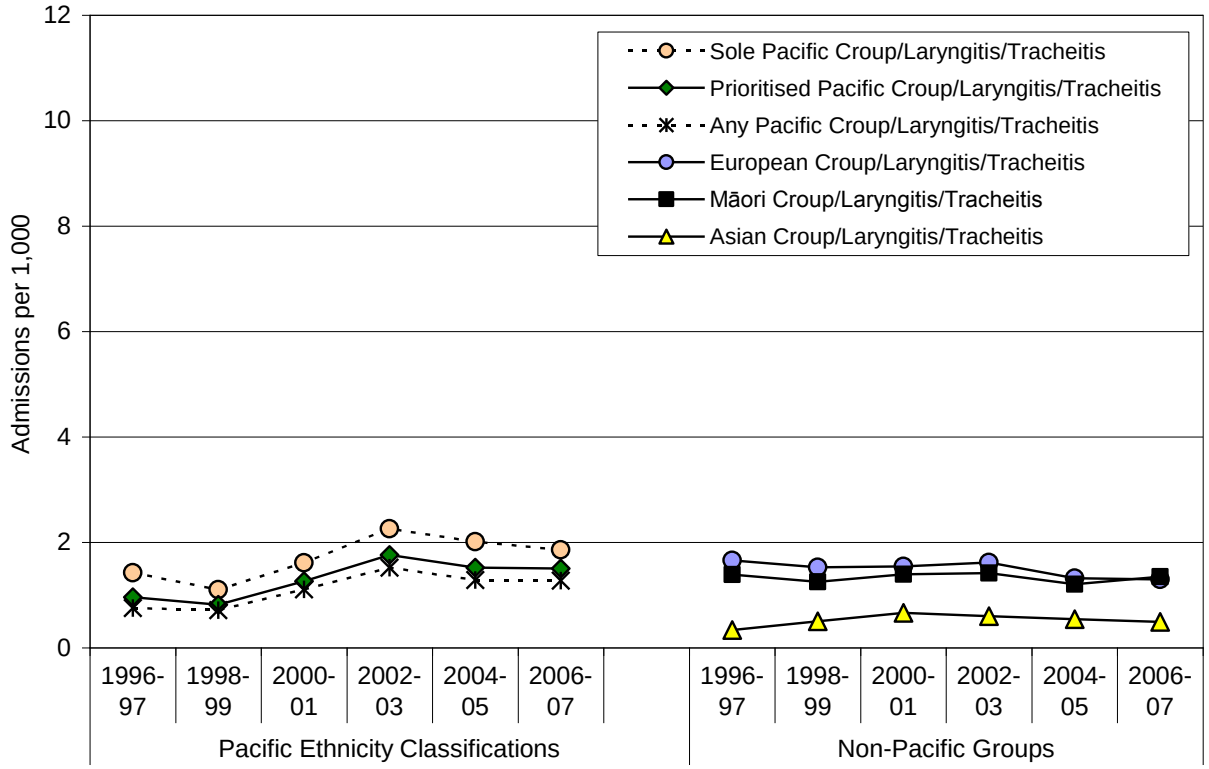
Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only); Denominator-Census. Note: Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted

Table 36. Risk Factors for Acute and Arranged Hospital Admissions for Acute URTI (excluding Croup) in Children 0-14 yrs, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	2.55	1.00		1-2	2.58	1.00	
2	2.61	1.02	0.94 - 1.11	3-4	3.20	1.24	1.17 - 1.31
3	2.59	1.02	0.94 - 1.11	5-6	4.33	1.68	1.59 - 1.77
4	3.81	1.50	1.39 - 1.62	7-8	5.63	2.19	2.08 - 2.30
5	3.78	1.48	1.37 - 1.60	9-10	6.68	2.59	2.47 - 2.72
6	4.88	1.92	1.78 - 2.06	Prioritised Ethnicity			
7	4.77	1.87	1.74 - 2.01	European	4.11	1.00	
8	6.46	2.54	2.37 - 2.72	Māori	5.53	1.35	1.30 - 1.39
9	6.71	2.63	2.46 - 2.82	Pacific	7.03	1.71	1.64 - 1.79
10	6.65	2.61	2.44 - 2.79	Asian	3.57	0.87	0.82 - 0.92
Gender				Urban / Rural			
Female	4.28	1.00		Urban	4.91	1.00	
Male	4.88	1.14	1.11 - 1.17	Rural	2.73	0.56	0.53-0.58

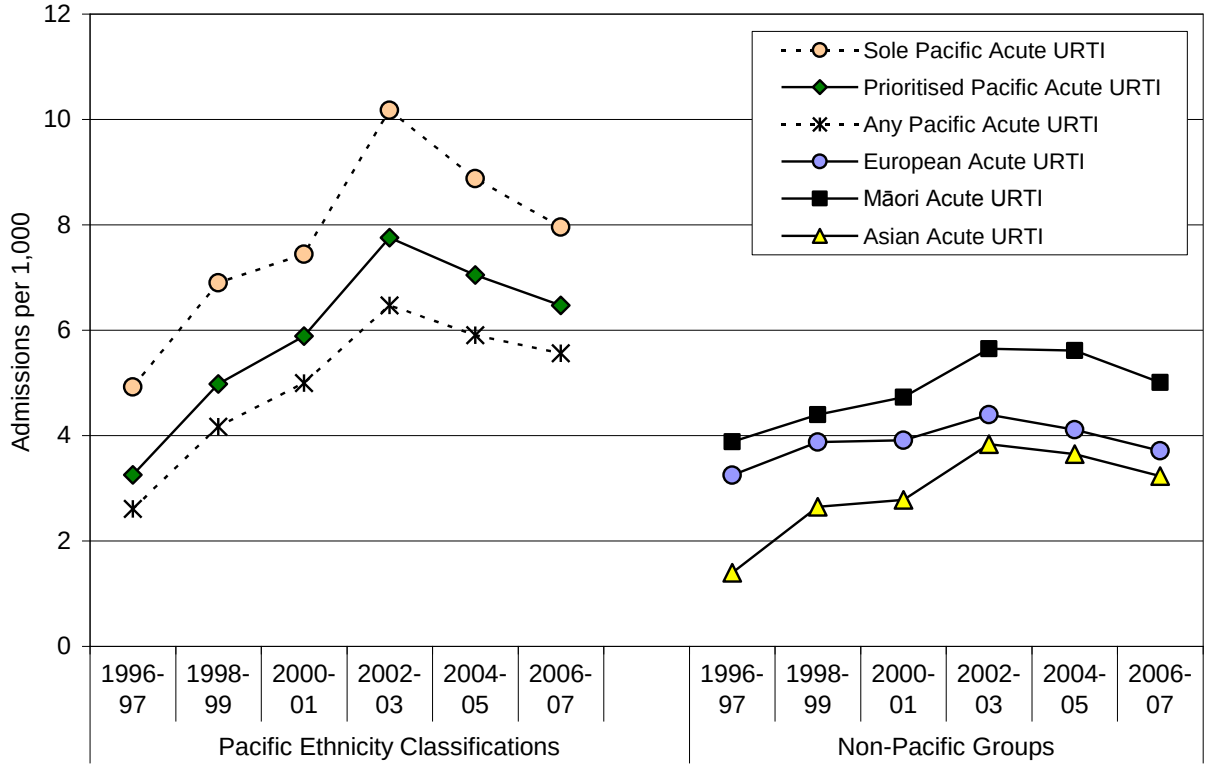
Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only); Denominator-Census. Note: Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted; Acute URTI includes Acute unspecified URTI, tonsillitis, pharyngitis, sinusitis, nasopharyngitis (cold) and epiglottitis

Figure 37. Acute and Arranged Hospital Admissions for Croup / Laryngitis / Tracheitis in Children 0-14 Years by Ethnicity, New Zealand 1996-2007



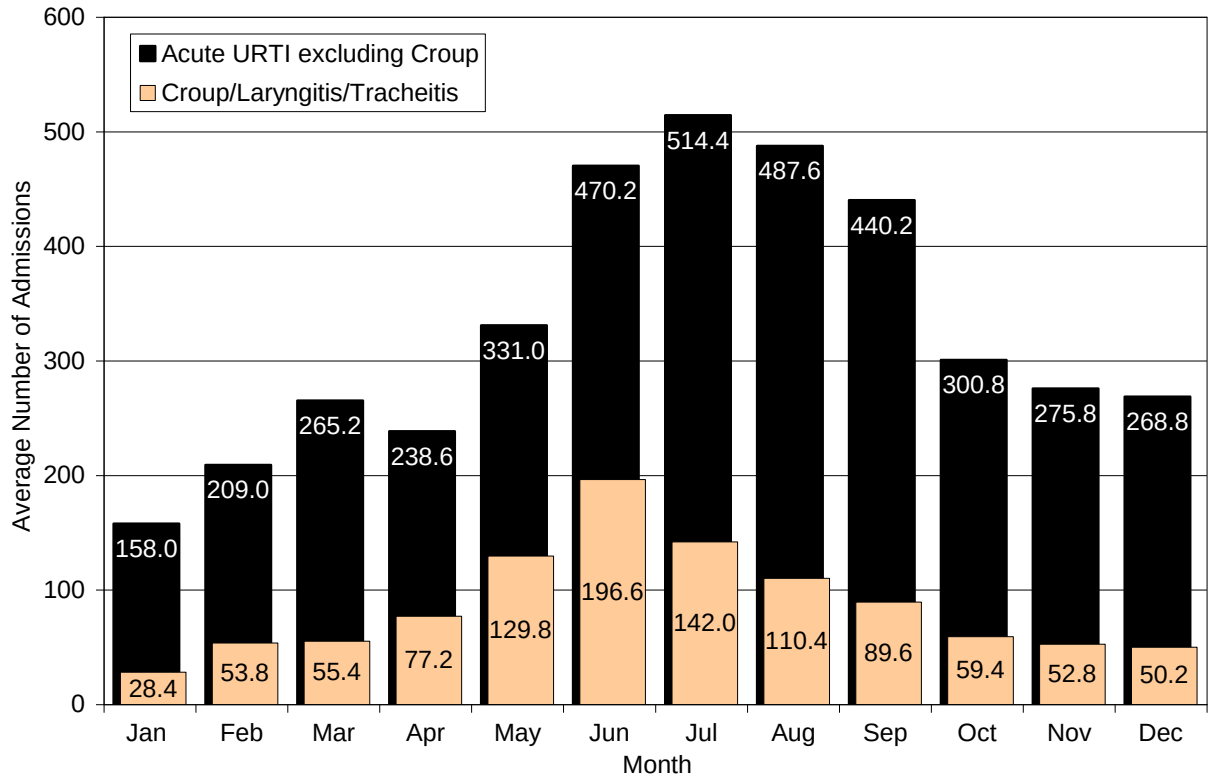
Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only); Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 38. Acute and Arranged Hospital Admissions for Acute Upper Respiratory Tract Infections (excluding Croup) in Children 0-14 Years by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only); Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details). Acute URTI includes Acute unspecified URTI, tonsillitis, pharyngitis, sinusitis, nasopharyngitis (cold) and epiglottitis.

Figure 39. Average Number of Acute and Arranged Hospital Admissions per Month for Acute Upper Respiratory Infections in Children 0-14 Years, New Zealand 2003-2007



Source: National Minimum Dataset

Acute Upper Respiratory Infections amongst Pacific Groups in New Zealand

Pacific Group Trends

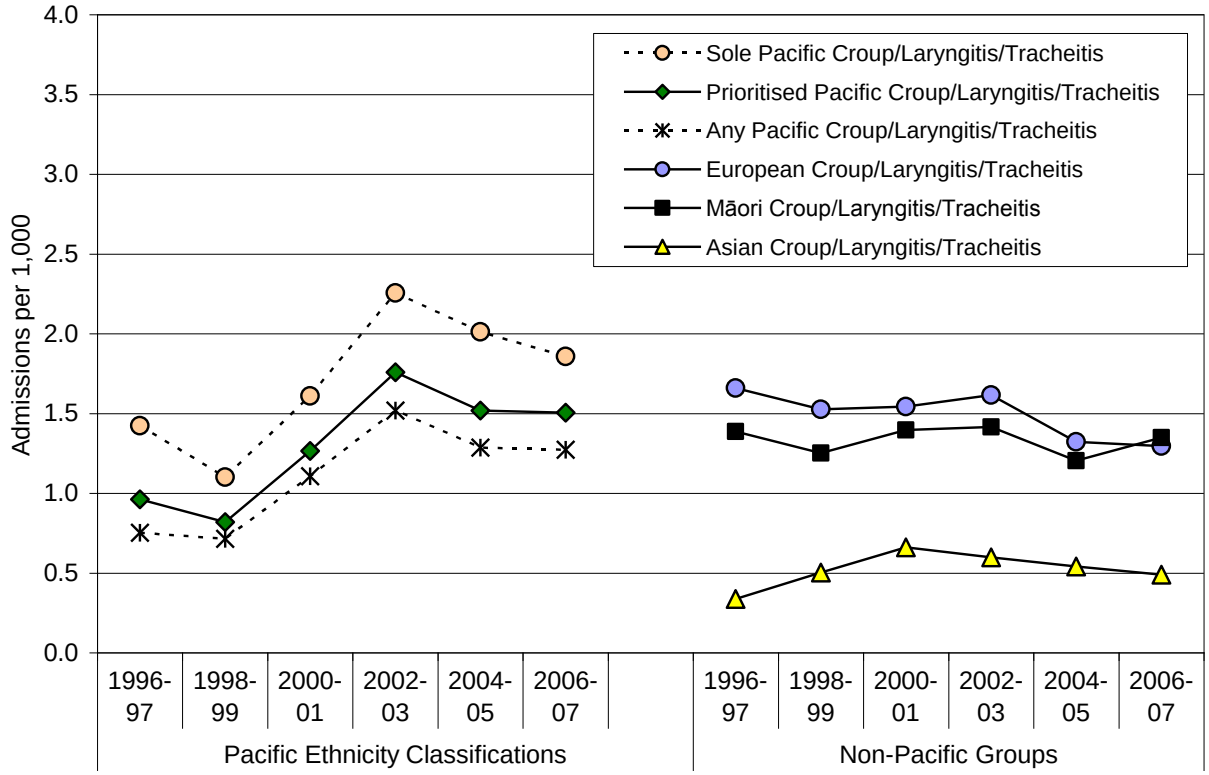
In New Zealand during 1996-2007, (using the Sole / Any Classification) there were no marked differences in croup / laryngitis / tracheitis rates between Samoan, Tongan or Cook Island Māori children (**Figure 40**). In contrast, admissions for acute URTIs were consistently higher for Samoan and Tongan children than for Cook Island Māori children, with admissions in each ethnic group also being higher for those in the Sole than the Any categories (**Figure 41**).

Distribution by Pacific Group

In New Zealand during 2003-2007 (using the Sole / Any classification), Croup / Laryngitis / Tracheitis admissions for Any Samoan, Tongan, Cook Island Māori and Other Pacific children were similar to those for non-Māori non-Pacific children, although rates for children belonging Solely to these four ethnic groups were *significantly higher* (**Table 37**).

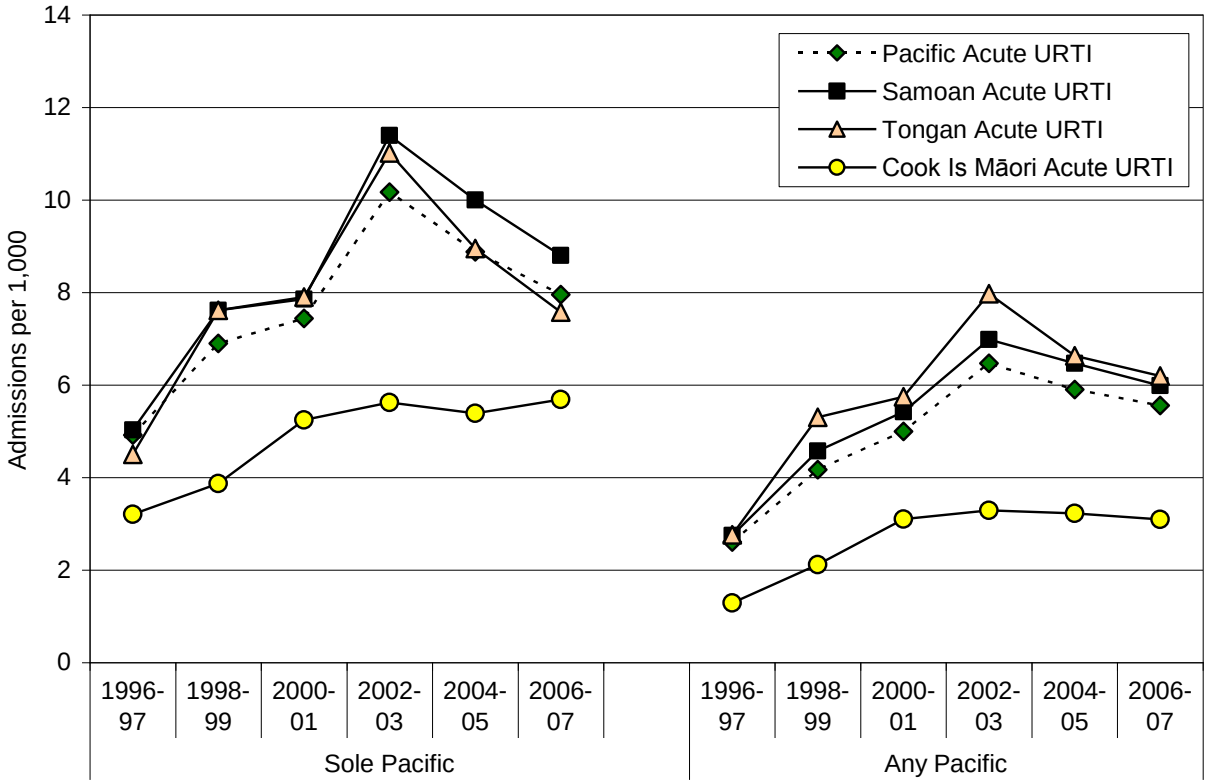
In New Zealand during 2003-2007 (using the Sole / Any classification), acute URTI admissions for Any and Sole Samoan, Tongan, Fijian and Other Pacific children, as well as for Sole Cook Island Māori and Niuean children were *significantly higher* than for non-Māori non-Pacific children. In contrast, admissions for Any Cook Island Māori and Niuean children were significantly lower than for non-Māori non-Pacific children (Error! Reference source not found.).

Figure 40. Acute / Arranged Hospital Admissions for Croup / Laryngitis / Tracheitis in Pacific Children 0-14 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only); Denominator-Census; Note: Ethnicity assigned using Any/Sole Classification (see page 333 for details).

Figure 41. Acute / Arranged Hospital Admissions for Acute Upper Respiratory Tract Infections (excluding Croup) in Pacific Children 0-14 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only); Denominator-Census;. Note: Ethnicity assigned using Any/Sole Classification (see page 333 for details). Acute URTI includes Acute unspecified URTI, tonsillitis, pharyngitis, sinusitis, nasopharyngitis (cold) and epiglottitis.

Table 37. Distribution of Acute / Arranged Hospital Admissions for Acute Upper Respiratory Infections in Pacific Children 0-14 Years by Pacific Group, New Zealand 2003-2007

Any Pacific										
Pacific Group	Croup / Laryngitis / Tracheitis					Acute Upper Respiratory Tract Infections (excluding Croup)				
	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	305	61.0	1.25	1.07	0.95-1.20	1,578	315.6	6.45	1.63	1.55-1.72
Any Tongan	129	25.8	1.26	1.07	0.90-1.28	690	138.0	6.72	1.70	1.57-1.83
Any Cook Island Māori	129	25.8	1.10	0.94	0.79-1.12	387	77.4	3.30	0.83	0.75-0.92
Any Niuean	24	4.8	0.55	0.47	0.31-0.70	139	27.8	3.17	0.80	0.68-0.95
Any Fijian	10	2.0	0.67	0.57	0.31-1.06	103	20.6	6.86	1.73	1.43-2.10
Any Tokelauan	8	1.6	0.57	0.49	0.24-0.97	45	9.0	3.19	0.81	0.60-1.08
Any Other Pacific	22	4.4	1.48	1.27	0.83-1.93	81	16.2	5.46	1.38	1.11-1.72
Any Pacific	601	120.2	1.22	1.05	0.96-1.14	2,921	584.2	5.94	1.50	1.44-1.56
Any Māori	1,242	248.4	1.25	1.07	1.00-1.14	5,510	1,102.0	5.53	1.40	1.35-1.44
Non-Māori Non-Pacific	3,450	690.0	1.17	1.00		11,673	2,334.6	3.96	1.00	
Sole Pacific										
Pacific Group	Croup / Laryngitis / Tracheitis					Acute Upper Respiratory Tract Infections (excluding Croup)				
	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	234	46.8	1.86	1.59	1.40-1.82	1,250	250.0	9.95	2.51	2.37-2.66
Sole Tongan	101	20.2	1.68	1.44	1.18-1.75	531	106.2	8.83	2.23	2.05-2.43
Sole Cook Island Māori	82	16.4	1.95	1.67	1.34-2.08	247	49.4	5.88	1.49	1.31-1.68
Sole Niuean	14	2.8	1.58	1.35	0.80-2.29	60	12.0	6.78	1.71	1.33-2.21
Sole Fijian	6	1.2	1.28	1.09	0.49-2.44	40	8.0	8.54	2.16	1.58-2.94
Sole Tokelauan	6	1.2	1.62	1.39	0.62-3.09	21	4.2	5.68	1.43	0.94-2.20
Sole Other Pacific	17	3.4	2.72	2.33	1.45-3.75	58	11.6	9.29	2.35	1.82-3.04
Sole Pacific	462	92.4	1.84	1.57	1.43-1.73	2,235	447.0	8.89	2.25	2.15-2.35
Sole Māori	896	179.2	2.09	1.79	1.66-1.93	4,237	847.4	9.90	2.50	2.41-2.59
Non-Māori Non-Pacific	3,450	690.0	1.17	1.00		11,673	2,334.6	3.96	1.00	

Source: Numerator-National Minimum Dataset; denominator-Census Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate ratios are compared to the Non-Māori Non-Pacific group and are unadjusted.

Waiting List Admissions for (Adeno)Tonsillectomy

New Zealand Distribution and Trends

Indications for (Adeno)Tonsillectomy: New Zealand

In New Zealand during 2003-2007, chronic tonsillitis was the single most common reason why Any and Sole Pacific children were admitted from the waiting list for (adeno)tonsillectomy, followed by hypertrophy of the tonsils and adenoids. During this period, admissions for (adeno)tonsillectomy were higher for Total New Zealand > Sole Pacific > Any Pacific children (**Table 38**).

New Zealand Trends

In New Zealand, waiting list admissions for (adeno)tonsillectomy increased during the 1990s, reached a peak in 1998-99, and then declined (**Figure 42**).

New Zealand Distribution by Age and Indication

In New Zealand during 2003-2007, waiting list admissions for (adeno)tonsillectomy were very infrequent during the first year of life, but rose thereafter to peak amongst those 3-6 years of age, before declining again in mid-late childhood. This profile was remarkably similar for all of the major indications for (adeno)tonsillectomy (**Figure 43**).

NZ Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

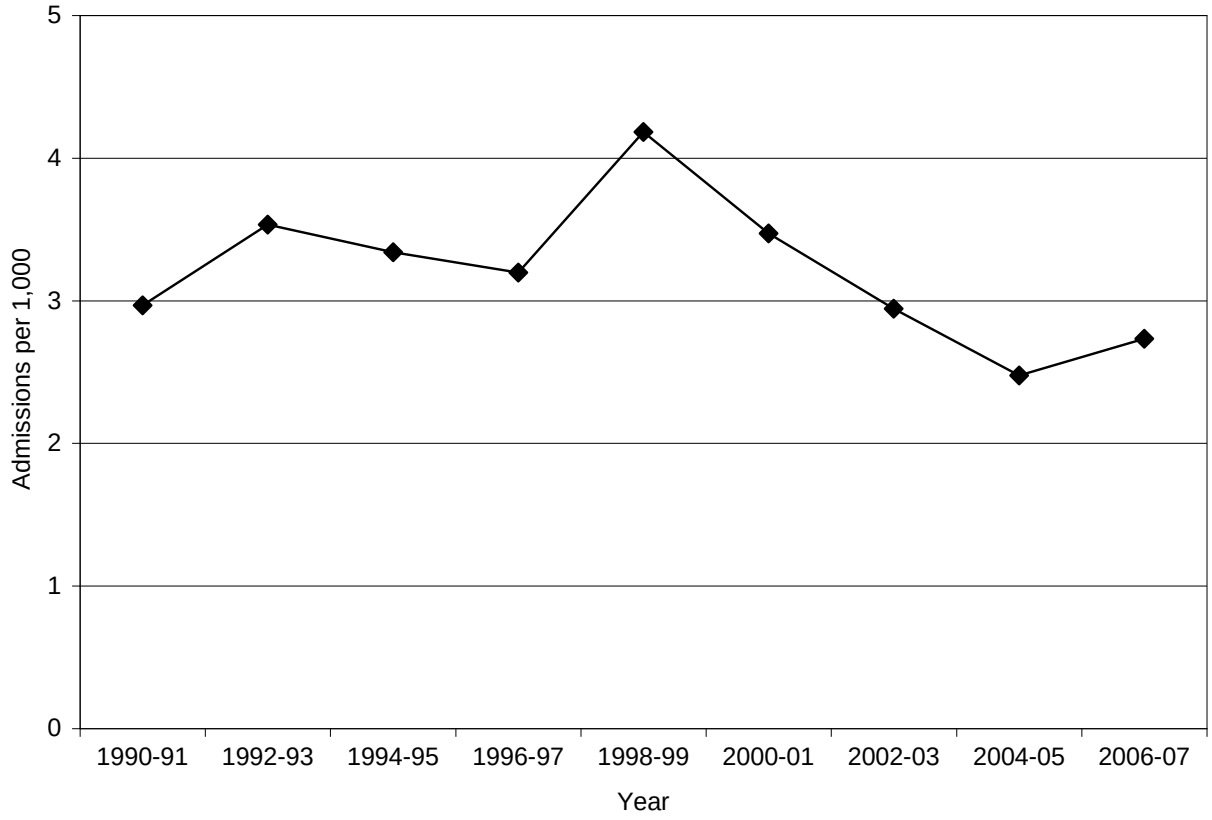
In New Zealand during 2003-2007, waiting list admissions for (adeno)tonsillectomy were *significantly lower* for Pacific children than for Māori or European children. Admissions were however, *significantly higher* for those in urban or more deprived areas (**Table 39**).

Table 38. Waiting List Admissions for (Adeno)Tonsillectomy by Primary Diagnosis, Any and Sole Pacific vs. New Zealand Children Aged 0-14 Years, 2003-2007

Primary Diagnosis	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	% of Total
Any Pacific				
Chronic Tonsillitis	355	71.0	0.72	54.4
Hypertrophy Tonsils/Adenoids	209	41.8	0.43	32.1
Sleep Apnoea	62	12.4	0.13	9.5
Other Diagnoses	26	5.2	0.05	4.0
Total	652	130.4	1.33	100.0
Sole Pacific				
Chronic Tonsillitis	198	39.6	0.79	54.5
Hypertrophy Tonsils/Adenoids	118	23.6	0.47	32.5
Sleep Apnoea	36	7.2	0.14	9.9
Other Diagnoses	11	2.2	0.04	3.0
Total	363	72.6	1.44	100.0
New Zealand				
Chronic Tonsillitis	7,681	1536.2	1.78	66.9
Hypertrophy Tonsils/Adenoids	2,539	507.8	0.59	22.1
Sleep Apnoea	933	186.6	0.22	8.1
Other Diagnoses	327	65.4	0.08	2.8
Total	11,480	2,296.0	2.66	100.0

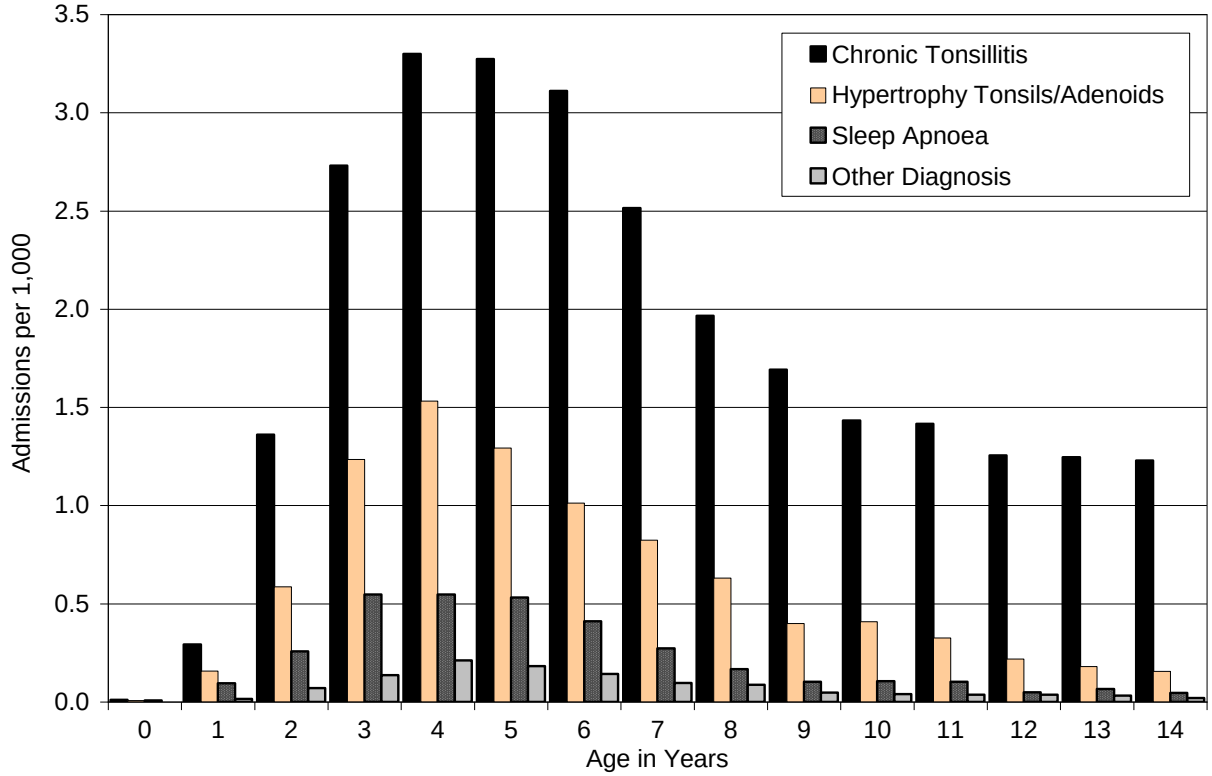
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Figure 42. Waiting List Admissions for (Adeno)Tonsillectomy in Children Aged 0-14 Years, New Zealand 1990-2007



Source: Numerator-National Minimum Dataset (Waiting List Admissions Only); Denominator-Census.

Figure 43. Waiting List Admissions for (Adeno)Tonsillectomy by Primary Diagnosis and Age in Children 0-14 Years, New Zealand 2003-2007



Source: Numerator-National Minimum Dataset (Waiting List Admissions Only); Denominator-Census

Table 39. Risk Factors for Waiting List Admissions for (Adeno)Tonsillectomy in Children 0-14 Years, New Zealand 2003-2007

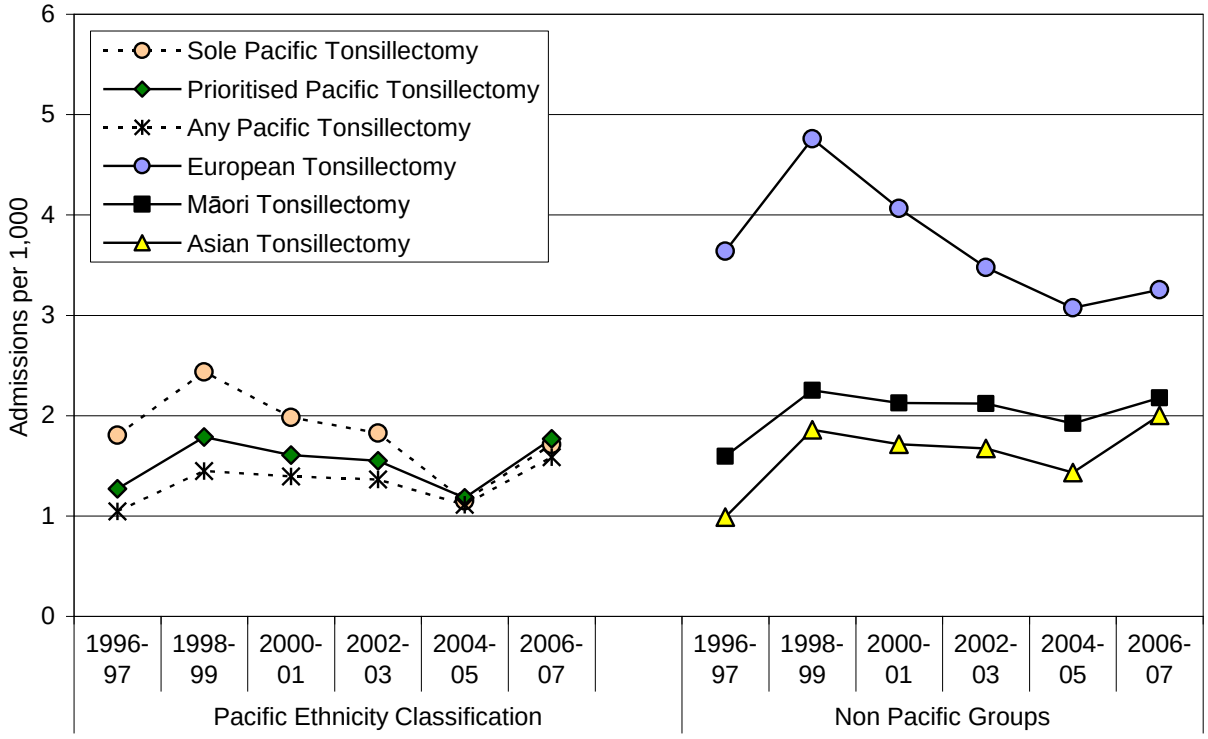
Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	1.53	1.00		1-2	1.57	1.00	
2	1.61	1.05	0.95 - 1.17	3-4	2.19	1.40	1.30 - 1.50
3	1.87	1.22	1.10 - 1.36	5-6	3.00	1.91	1.79 - 2.04
4	2.52	1.64	1.49 - 1.81	7-8	3.63	2.32	2.17 - 2.47
5	2.84	1.85	1.68 - 2.04	9-10	2.90	1.85	1.73 - 1.97
6	3.16	2.06	1.88 - 2.26	Prioritised Ethnicity			
7	3.43	2.24	2.05 - 2.46	European	3.22	1.00	
8	3.83	2.50	2.29 - 2.74	Māori	2.07	0.64	0.61 - 0.67
9	3.62	2.37	2.17 - 2.59	Pacific	1.45	0.45	0.41 - 0.49
10	2.31	1.51	1.37 - 1.65	Asian	1.72	0.53	0.49 - 0.58
Gender				Urban / Rural			
Female	2.71	1.00		Urban	2.80	1.00	
Male	2.61	0.96	0.93 - 1.00	Rural	1.88	0.67	0.63-0.71

Source: Numerator-National Minimum Dataset (Waiting List Admissions Only); Denominator-Census; Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted

New Zealand Ethnic Specific Trends

In New Zealand during 1996-2007, waiting list admissions for (adeno)tonsillectomy were consistently higher for European > Māori > Pacific and Asian children, although admissions declined for European children during this period. While admissions for Sole Pacific children were higher than for Any Pacific children during the early part of this period, these differences diminished as time progressed (**Figure 44**).

Figure 44. Waiting List Admissions for (Adeno)Tonsillectomy in Children 0-14 Years by Ethnicity, New Zealand 1996-2007

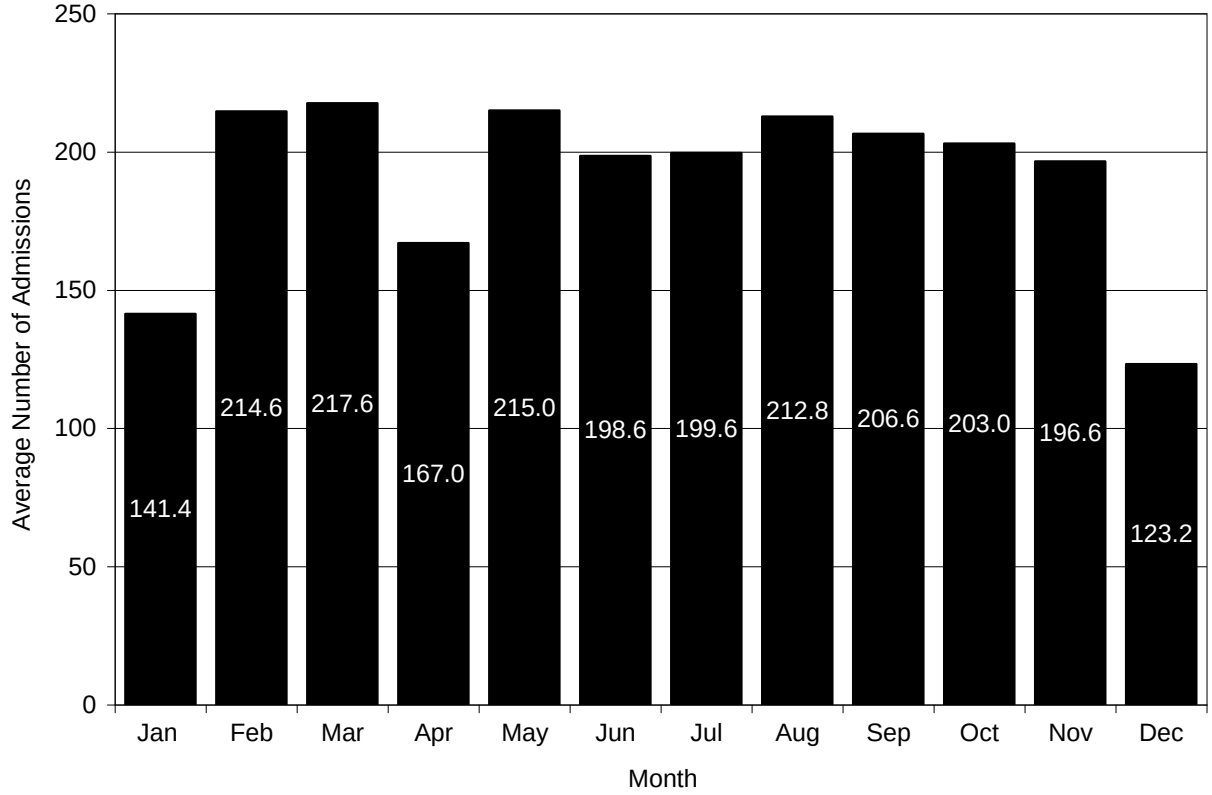


Source: Numerator-National Minimum Dataset (Waiting List Admissions Only); Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

New Zealand Distribution by Season

In New Zealand during 2003-2007, waiting list admissions for (adeno)tonsillectomy did not demonstrate marked seasonal variations, although admissions were lowest during December and January (**Figure 45**).

Figure 45. Average Number of Waiting List Admissions for Tonsillectomy (+/-Adenoidectomy) per Month in Children 0-14 Years, New Zealand 2003-2007



Source: National Minimum Dataset (Waiting List Admissions Only).

Waiting List Admissions for (Adeno)Tonsillectomy Amongst Pacific Groups in New Zealand

Pacific Group Trends

In New Zealand during 1996-2007, (using the Sole / Any Classification), waiting list admissions for (adeno)tonsillectomy were generally lower for Sole and Any Tongan and Any Cook Island Māori children than they were for Sole or Any Samoan children (**Figure 46**).

Distribution by Pacific Group

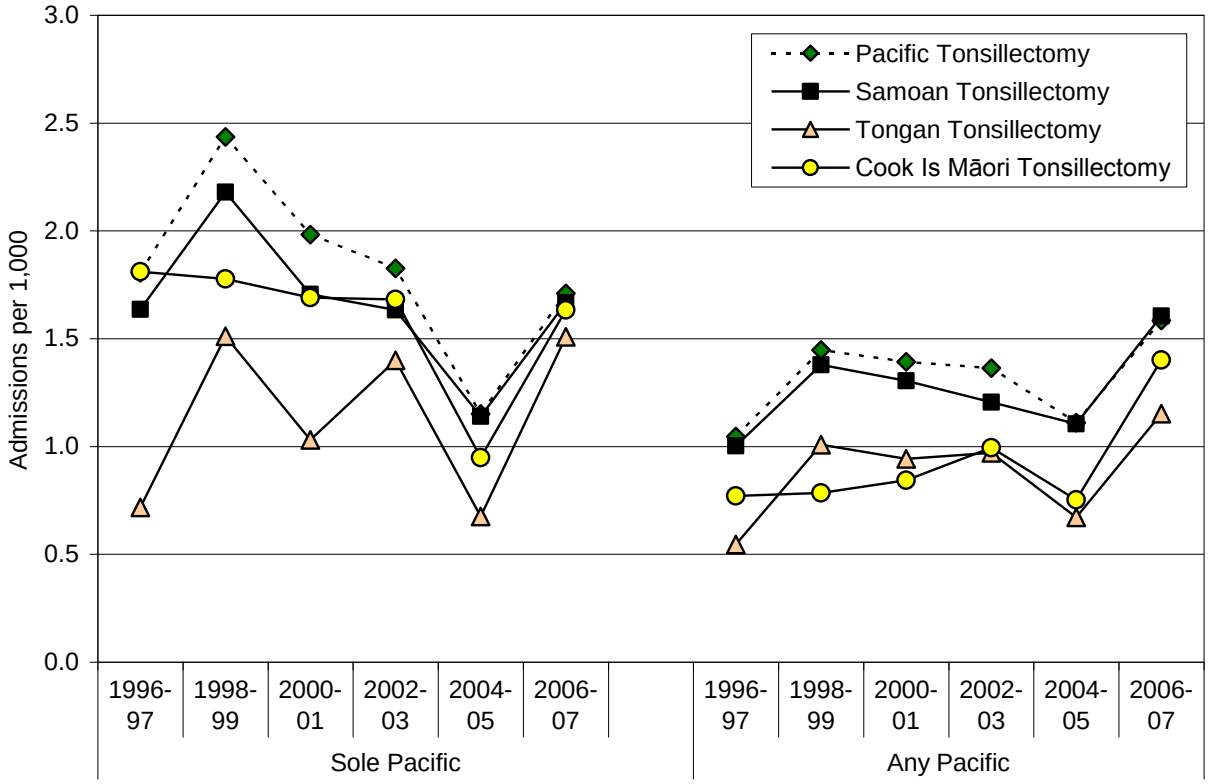
In New Zealand during 2003-2007 (using the Sole / Any classification), (adeno)tonsillectomy waiting list admissions for each of the Any Pacific groups (with the exception of Any Fijian children) were *significantly lower* than for non-Māori non-Pacific children. Admissions for Sole Samoan, Tongan and Cook Island Māori children were also *significantly lower* than for non-Māori non-Pacific children (**Table 40**).

Table 40. Distribution of Waiting List Admissions for (Adeno)Tonsillectomy in Pacific Children 0-14 Years by Pacific Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	321	64.2	1.31	0.44	0.39-0.49
Any Tongan	96	19.2	0.94	0.31	0.25-0.38
Any Cook Island Māori	125	25.0	1.07	0.35	0.30-0.42
Any Niuean	60	12.0	1.37	0.45	0.35-0.59
Any Fijian	33	6.6	2.20	0.73	0.52-1.03
Any Tokelauan	15	3.0	1.06	0.35	0.21-0.59
Any Other Pacific	23	4.6	1.55	0.52	0.34-0.78
Any Pacific	652	130.4	1.33	0.44	0.41-0.48
Any Māori	2,064	412.8	2.07	0.69	0.66-0.72
Non-Māori Non-Pacific	8,878	1,775.6	3.01	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	180	36.0	1.43	0.48	0.41-0.55
Sole Tongan	68	13.6	1.13	0.38	0.30-0.48
Sole Cook Island Māori	54	10.8	1.29	0.43	0.33-0.56
Sole Niuean	25	5.0	2.82	0.94	0.63-1.39
Sole Fijian	15	3.0	3.20	1.06	0.64-1.76
Sole Tokelauan	5	1.0	1.35	0.45	0.19-1.08
Sole Other Pacific	14	2.8	2.24	0.75	0.44-1.26
Sole Pacific	363	72.6	1.44	0.48	0.43-0.53
Sole Māori	1,374	274.8	3.21	1.07	1.01-1.13
Non-Māori Non-Pacific	8,878	1,775.6	3.01	1.00	

Source: Numerator-National Minimum Dataset; denominator-Census Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate ratios are compared to the Non-Māori Non-Pacific group and are unadjusted.

Figure 46. Waiting List Admissions for (Adeno)Tonsillectomy in Pacific Children 0-14 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset (Waiting List Admissions Only); Denominator-Census. Note: Ethnicity assigned using Any/Sole Classification (see page 333 for details).

Summary

Acute Upper Respiratory Infections

During 2003-2007, acute unspecified upper respiratory tract infections were the most frequent cause of acute upper respiratory tract infection (URTI) admissions for Any and Sole Pacific children, followed by croup / acute laryngitis / tracheitis. During this period, croup / laryngitis / tracheitis admissions were *significantly higher* for Pacific children (than for European or Asian children), males and those in deprived or urban areas, while acute URTI admissions were *significantly higher* for Pacific > Māori > European > Asian children, males and those in deprived or urban areas.

During 1996-2007, (using the Sole / Any Classification) there were no marked differences in croup / laryngitis / tracheitis rates between Samoan, Tongan or Cook Island Māori children. In contrast, admissions for acute URTIs were consistently higher for Samoan and Tongan children than for Cook Island Māori children, with rates within each ethnic group also being higher for the Sole than the Any categories. During 2003-2007 croup / laryngitis / tracheitis admissions for Any Samoan, Tongan, Cook Island Māori and Other Pacific children were similar to those for non-Māori non-Pacific children, although rates for children belonging Solely to these four ethnic groups were *significantly higher*. For acute URTI admissions, rates for Any and Sole Samoan, Tongan, Fijian and Other Pacific children, as well as for Sole Cook Island Māori and Niuean children were *significantly higher* than for non-Māori non-Pacific children. In contrast, admissions for Any Cook Island Māori and Niuean children were significantly lower than for non-Māori non-Pacific children

Waiting List Admissions for (Adeno)Tonsillectomy

During 2003-2007, chronic tonsillitis was the single most common reason why Any and Sole Pacific children were admitted from the waiting list for (adeno)tonsillectomy, followed by hypertrophy of the tonsils and adenoids. During this period, admissions for

(adeno)tonsillectomy were *significantly lower* for Pacific children than for Māori or European children. Admissions were *significantly higher* for those in urban or more deprived areas.

During 1996-2007, (using the Sole / Any Classification), waiting list admissions for (adeno)tonsillectomy were generally lower for Sole and Any Tongan and Any Cook Island Māori children than for Sole or Any Samoan children. During 2003-2007, admissions for each of the Any Pacific groups (with the exception of Any Fijian children) were *significantly lower* than for non-Māori non-Pacific children. Admissions for Sole Samoan, Tongan and Cook Island Māori children were also *significantly lower* than for non-Māori non-Pacific children.

Policy Documents and Evidence Based Reviews Relevant to the Management of Upper Respiratory Infections

In New Zealand there are no policy documents which focus solely on the prevention of upper respiratory tract infections. A range of documents however consider approaches to respiratory / infectious diseases and their risk factors more generally, and these have been reviewed in other sections of this report:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 31 on Page 119
2. **Interventions Aimed at Smoking** / **Tobacco Control:** Table 32 on Page 120.
3. **Interventions Aimed at Housing and Household Crowding:** Table 33 on Page 121
4. **Interventions Aimed at Breastfeeding:** Breastfeeding Section on Page 58

Similarly, there are few evidence based reviews which focus solely on interventions to reduce upper respiratory infections at the population level. A number of reviews however, consider the most appropriate management for particular URTIs (e.g. recurrent tonsillitis and acute pharyngitis) and these are reviewed briefly in **Table 41**.

Table 41. Policy Documents and Evidence Based Reviews Relevant to the Management of Upper Respiratory Infections

Ministry of Health Policy Documents
In New Zealand there are no policy documents which focus specifically on the prevention of upper respiratory tract infections, although a range of documents consider the prevention of infectious and respiratory diseases more generally (see links on previous page)
Systematic and Other Reviews from the International Literature
Burton M, Towler B, Glasziou P. **Tonsillectomy Versus Non-Surgical Treatment For Chronic/Recurrent Acute Tonsillitis.** Cochrane Database of Systematic Reviews 1999, Issue 3. This review considered the effectiveness of tonsillectomy vs. non-surgical treatment for children with chronic / recurrent acute tonsillitis. Only two trials assessed this issue, and significant baseline differences between the surgical and non-surgical groups and the inclusion of children also undergoing adenoidectomy prevented firm conclusions being drawn from the first published trial. Limited and insufficient information was available from the second study and further details are awaited. The authors thus concluded that the effectiveness of tonsillectomy had not been formally evaluated and further trials addressing this issue were required.
A Joint Position Paper of the Paediatrics & Child Health Division of the Royal Australasian College of Physicians and the Australian Society of Otolaryngology, Head and Neck Surgery. **Indications for Tonsillectomy and Adenotonsillectomy in Children**. 2008, Sydney. This position paper states that tonsillectomy/adenotonsillectomy is indicated for episodes of recurrent acute tonsillitis. As a guide, 7 episodes in the preceding 12 months, or 5 in each year for 24 months, or 3 per year for 3 years should be considered an indication for surgery. However, account should be taken of the clinical severity of the episodes, which may result in as little as one less episode of sore throat with fever per year being an indication for a tonsillectomy.
The National Heart Foundation of New Zealand and Cardiac Society of Australia and New Zealand. **New Zealand Guidelines for Rheumatic Fever 2. Group A Streptococcal Sore Throat Management. Evidence-based, best practice Guidelines**. 2007, The National Heart Foundation of New Zealand: Auckland. The primary focus of this guideline is preventing acute rheumatic fever by ensuring Group A Streptococcal throat infections are identified and treated appropriately. The guideline outlines an algorithm for the management of sore throats, which is based on a number of known risk factors and clinical criteria.

Å Hearing Screening, Otitis Media and the Insertion of Grommets

Introduction

Hearing in infants and young children is essential for speech and language development and its loss during early life may lead to significant disability [186]. From a clinical perspective, hearing loss is often divided into two categories: *Sensorineural Hearing Loss*, arising from problems in the cochlear (inner ear) or auditory nerve (often due to inherited conditions, congenital anomalies, extreme prematurity or in-utero infections [186]) and *Conductive Hearing Loss,* arising from problems in the middle or external ear (often the result of chronic otitis media with effusion). The following section reviews conditions contributing to *Conductive Hearing Loss* among Pacific children in New Zealand and is divided into two parts as follows:

1. **Hearing Screening at School Entry**: This section uses data from the National Audiology Centre to explore the proportion of 5 year old Pacific children failing hearing screening (pure tone audiometry) at school entry (Note: While the majority of Pacific children failing screening will have a conductive hearing loss arising from otitis media with effusion [187], screening may also identify a small number of children with sensorineural hearing loss (although distinguishing between the two is not possible using currently available data).
2. **Hospitalisations for Otitis Media / the Insertion of Grommets**: This section uses data from the National Minimum Dataset to explore acute / arranged hospital admissions for otitis media and waiting list admissions for grommets amongst Pacific children aged 0-14 years in New Zealand.

Hearing Screening at School Entry

Introduction

Hearing loss is measured in decibels (dB) across a range of frequencies, with hearing being considered normal between 0 and -10dB (i.e. a ≤10dB reduction). Losses of -26 to 40dB are considered mild, -41 to 65dB moderate, -66 to 95dB severe, and >95dB profound. In clinical terms, a 35-40dB hearing loss in the better ear is considered educationally significant, with bilateral moderate to severe hearing impairment affecting a child's' speech, language and general development. The consequences of unilateral mild hearing impairment however, are less clear [188].

In New Zealand until recently, the Well Child Tamariki Ora National Schedule utilised the following timeline for the screening of young children for hearing loss [189]:

1. Newborn (0-5 days): Lead maternity carers / paediatricians screen children for risk factors of sensorineural hearing loss (e.g. severe neonatal jaundice, extreme prematurity, in-utero infections, cranio-facial anomalies, positive family history). Where risk factors are present children are referred to an audiologist for diagnostic assessment.
2. Hearing Surveillance and Surveillance for Otitis Media with Effusion by Well Child Provider at the 6 week, 3, 5, 10, 15 and 24 month visits and referral if hearing impairment or otitis media with effusion suspected.
3. Age 3 Years: Screening at registered pre-school venues using tympanometry to detect chronic middle ear effusion. Immediate referral if evidence of obstruction or perforation, otherwise referral following 2 failed tympanometry tests with a 10-16 week retest interval.
4. Age 5 Years: Screening of all school new entrants with audiometry and tympanometry to detect undiagnosed hearing loss or persistent middle ear disorder. Immediate referral if hearing loss is marked, otherwise referral following 2 failed tests with a 10-16 week test-retest interval.

During the past 2-3 years a number of changes to this schedule have occurred, but as these changes have not yet been implemented in many DHBs, the above approach remains relevant for detecting hearing loss in the 0-5 age group. Two new screening events however, will become increasingly important over the next 5 years. These are:

1. **The Universal Newborn Hearing Screening and Early Identification Programme**: In May 2006, the Government announced funding for a Newborn Hearing Screening Programme, which would screen all newborn babies for sensorineural hearing loss. Roll out began in July 2007 in three DHBs with existing programmes (Waikato, Tairawhiti, and Hawke's Bay), and consultation is currently underway with a further nine DHBs who have expressed an interest in a 2008/09 roll out [190]. Once fully implemented, it is estimated the programme will identify most newborns with sensorineural hearing loss, with the remainder being identified during early childhood [188].
2. **The B4 School Check**: During 2008, the roll out of the B4 School Check saw hearing screening at school entry being replaced with screening at 4-5 years of age. At this Check, which occurs in a variety of locations including preschools, kohanga reo, churches and marae, registered nurses perform audiometry screening using the sweep test, with abnormal tests being followed up in a predetermined manner using agreed clinical pathways and referral criteria [188].

As at the time of writing, the B4 School check had not been implemented in all DHBs, the following section reviews the results of hearing screening at school entry for Pacific children in New Zealand using data from the National Audiology Centre.

Data Source and Methods

Definition

1. New Entrant Hearing Screening Coverage: Number of new entrant children screened, divided by the number enrolled in each school region at the beginning of July.
2. Failure of Pure Tone Audiometry: At least two thresholds 45dB or greater (this result is an immediate referral to audiology services if tympanometry is normal, or to the GP or specialist ear nurse if the tympanometry is abnormal). At least one threshold exceeding the screening levels of 30dB (500Hz) or 20dB (1000-4000Hz)- this results in the child being scheduled for a retest at the next visit (in 10-16 weeks time)

Data Source

New Zealand Hearing Screening Reports produced by the National Audiology Centre

Notes on Interpretation

Note 1: Hearing screening information in this section was obtained from the National Audiology Centre's annual reports. The National Audiology centre in turn receives this information from Vision Hearing Technicians and Public Health Nurses employed by DHBs and Health Trusts throughout NZ.

Note 2: Tests of statistical significance have not been applied to the data in this section, and thus any associations described do not imply statistical significance or non-significance.

Indicator Category

Proxy B-C

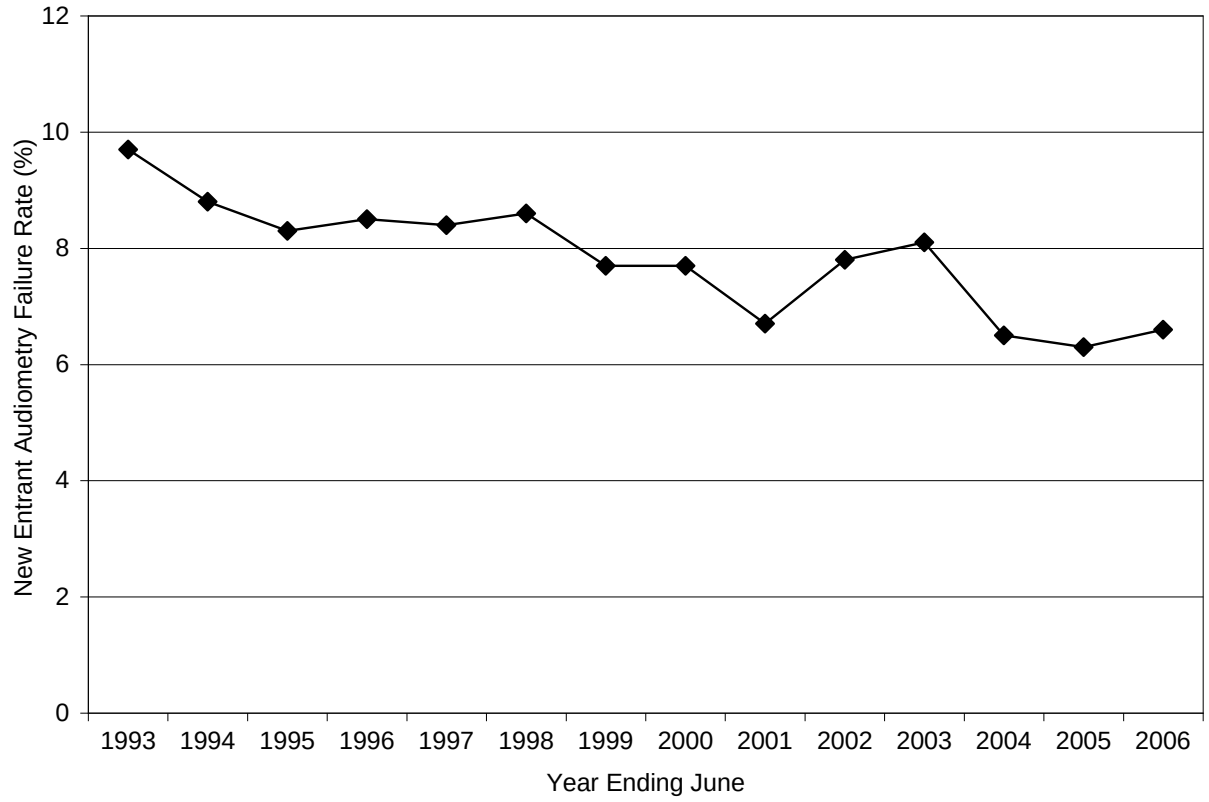
Coverage

In the year ending June 2006, new entrant hearing screening coverage nationally was 99%.

Audiometry Failure Rates

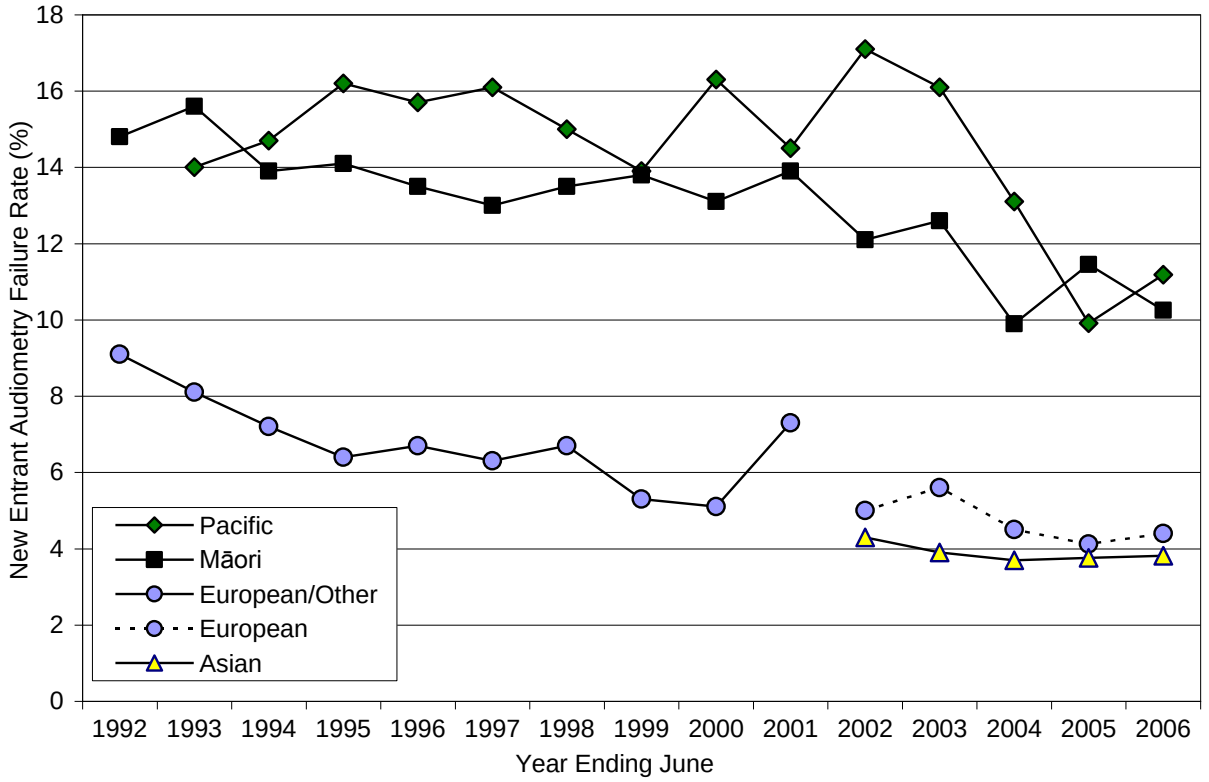
In New Zealand during 1993-2006 there was a gradual decline in audiometry failure rates at school entry, with overall rates falling from 9.7% in 1993, to 6.6% in 2006 (**Figure 47**). While rates for Pacific children also declined during this period (from 14.0% in 1992 to 11.2% in 2006), rates remained higher than for European / Other (1993-2001) and European and Asian (2002-2006) children throughout this period. Screening failure rates for Pacific children were also higher than for Māori children for the majority of this period (**Figure 48**).

Figure 47. Audiometry Failure Rates at School Entry (5 Years), New Zealand Years Ending June 1993-2006



Source: National Audiology Centre (via Greville Consulting)

Figure 48. New Entrant Audiometry Failure Rates at 5 Years by Ethnicity, New Zealand Years Ending June 1992-2006



Source: National Audiology Centre (via Greville Consulting)

Hospitalisations for Otitis Media / Insertion of Grommets

Introduction

Otitis media is one of the commonest childhood infections presenting in the primary care setting. It is also a frequent reason for antibiotic treatment and the admission to hospital for surgical intervention [191]. In New Zealand, acute otitis media is considered ambulatory sensitive, on the basis that appropriate management in primary care will prevent a large number of acute hospital admissions each year. In terms of its management, otitis media can be considered under the following three headings:

Å **Acute Otitis Media (AOM)**: AOM is caused by inflammation of the middle ear and is usually viral or bacterial in origin. Symptoms often follow an upper respiratory infection and include fever, irritability, ear pain and hearing loss, and on examination a red, opaque, bulging eardrum may be present +/- a purulent ear discharge [192]. In New Zealand, the prevalence of AOM amongst Pacific 2-year old children has been estimated at 1.9% [193]. Risk factors for AOM include age (peak incidence 6-11 months), a lack of breastfeeding, parental smoking and attendance at day care. In the acute phase, management includes pain relief, observation (selected mild cases) and antibiotics [191], while complications include perforation of the eardrum, mastoiditis and labyrinthitis (infection of the inner ear). In the longer term, some children develop recurrent acute otitis media and / or chronic middle ear effusions, for which surgical management may be indicated [192].

Otitis Media with Effusion (OME): OME is defined as the presence of a middle ear effusion (fluid) without signs or symptoms of acute infection. It may arise de-novo or following an episode of acute otitis media [191]. In New Zealand, the prevalence of OME in 2-year old Pacific children has been estimated at 25.4% [193], with risk factors in this group including attending day care >20 hours per week (5.2 times the risk) and regularly attending church (2.8 times the risk) [194].

While OME is common, most episodes resolve spontaneously (in one series 28% resolved by 3 months, 42% by 6 months and 59% by 9 months [191]), and thus if children are not at particular risk for speech, language or learning problems (e.g. children with Down Syndrome, autism, cranio-facial abnormalities), they may be managed with watchful waiting for at least 3 months [195]. Even with effusions persisting > 3 months, intervention may be unnecessary in asymptomatic children, but follow up is still required at 3-6 month intervals until the effusion has disappeared, significant hearing loss is identified, or structural abnormalities of the eardrum or middle ear are suspected. The decision to opt for surgical intervention is usually made on the basis of the child's hearing status, associated symptoms and developmental risk, and in most cases involves the insertion of grommets [195].

Grommets: Grommets (ventilation / tympanostomy tubes) are usually inserted to restore normal hearing in children with long-standing (>3-6 months) bilateral OME, or to prevent recurrent acute otitis media. The procedure, which aims to improve ventilation and pressure regulation in the middle ear, involves making a small incision in the eardrum (+/- the aspiration of middle ear fluid) and the insertion of a ventilation tube. While functioning time varies, on average most grommets last 6-12 months. In terms of their effectiveness, one recent review noted that while children receiving grommets spent less time with effusions and had improved hearing (average 9dB after the first 6 months, falling to 6dB after 12 months), grommets had no effect on language development or cognition in otherwise healthy children (Note: children at high risk of speech or developmental problems were excluded from these trials) [196].

Grommets however are not without their risks, with the above review also noting that children with grommets had an additional risk of tympanosclerosis [196]. Similarly, a recent review of 112 New Zealand children noted that one in four developed complications (otorrhoea or a non-functioning tube) in the post-operative period (10-14 days) and that Māori and Pacific children were significantly more likely to have a non-functioning tube (extruded early or blocked), highlighting the need for close follow up in the first few weeks after surgery [197].

The following section uses data from the National Minimum Dataset to explore acute and arranged hospital admissions for otitis media and other middle ear problems, as well as waiting list admissions for grommets in Pacific children aged 0-14 years.

Data Sources and Methods

Definition

1. *Acute and Arranged Hospital Admissions for Otitis Media in Children Aged 0-14 Years*
2. *Waiting List Admissions for the Insertion of Grommets in Children Aged 0-14 Years*

Data Sources

1. *Acute and Arranged Hospital Admissions for Otitis Media in Children Aged 0-14 Years*

Numerator: National Minimum Dataset: Acute and arranged hospital admissions for children 0-14 years with a primary ICD-10 diagnosis of: Otitis Media (H65-67); Eustachian Tube Disorders (H68, H69); Mastoiditis and Related Disorders (H70); Cholesteatoma of the Middle Ear (H71); Perforation / Other Disorders of the Tympanic Membrane (H72-73); and Other Disorders of the Middle Ear/Mastoid (H74-75).

2. *Waiting List Admissions for the Insertion of Grommets in Children Aged 0-14 Years*

Numerator: National Minimum Dataset: Waiting list admissions for children 0-14 years for the insertion of Grommets (primary procedure code ICD-10 41632).
Denominators: NZ Census

Notes on Interpretation

Note 1: *Appendix 4: The National Minimum Dataset* outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category Proxy B

New Zealand Distribution and Trends

Middle Ear Admissions by Primary Diagnosis

In New Zealand during 2003-2007, otitis media was the most frequent cause of acute / arranged hospital admissions for middle ear and mastoid conditions amongst Any and Sole Pacific children, although mastoiditis and perforations / other disorders of the eardrum also made a small contribution (**Table 42**).

Grommets Admissions by Primary Diagnosis

Similarly, otitis media was the single most frequent indication for a waiting list admission for the insertion of grommets amongst both Any and Sole Pacific children during 2003-2007, although mastoiditis and other related conditions made a smaller contribution (**Table 43**).

New Zealand Trends

In New Zealand, acute / arranged admissions for otitis media increased during the early 1990s, reached a peak in 1994-95 and thereafter declined. In contrast, waiting list admissions for the insertion of grommets increased rapidly between 1990-91 and 1992-93, fluctuated during the mid-1990s, and since 2000-01 have declined (**Figure 49**).

New Zealand Distribution by Age and Ethnicity

In New Zealand during 2003-2007, acute / arranged admissions for otitis media reached a peak between 1-2 years of age and thereafter gradually declined, with the age profile being remarkably similar for all ethnic groups. In contrast, waiting list admissions for grommets were highest for European > Māori > Pacific > Asian children during their pre-school years, but became higher for Pacific and Māori children than for European children during the primary school years (**Figure 50**).

Ethnic Trends in New Zealand

During 1996-2007 waiting list admissions for grommets were higher for Pacific, Māori and European children than for Asian / Indian children, while acute / arranged admissions for otitis media were generally higher for Māori and Pacific > European > Asian children. Amongst Pacific children, rates for both outcomes were higher for Sole than for Any Pacific children (**Figure 51**).

Table 42. Acute and Arranged Hospital Admissions for Conditions of the Middle Ear and Mastoid by Diagnosis, Any and Sole Pacific vs. New Zealand Children 0-14 Years, 2003-2007

Primary Diagnosis	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	% of Total
Any Pacific				
Å Otitis Media	499	99.8	1.02	92.6
Mastoiditis and Related Conditions	30	6.0	0.06	5.6
Perforation/Other Disorders Eardrum	4	0.8	0.01	0.7
All Other Disorders	6	1.2	0.01	1.1
Total	539	107.8	1.10	100.0
Sole Pacific				
Å Otitis Media	331	66.2	1.3171	92.2
Mastoiditis and Related Conditions	23	4.6	0.0915	6.4
Perforation/Other Disorders Eardrum	<5	s	s	s
All Other Disorders	<5	s	s	s
Total	359	71.8	1.43	100.0
New Zealand				
Å Otitis Media	3,873	774.6	0.90	92.5
Mastoiditis and Related Conditions	173	34.6	0.04	4.1
Perforation/Other Disorders Eardrum	95	19.0	0.02	2.3
Cholesteatoma of Middle Ear	28	5.6	0.01	0.7
Other Disorders Middle Ear / Mastoid	16	3.2	0.00	0.4
Total	4,185	837.0	0.97	100.0

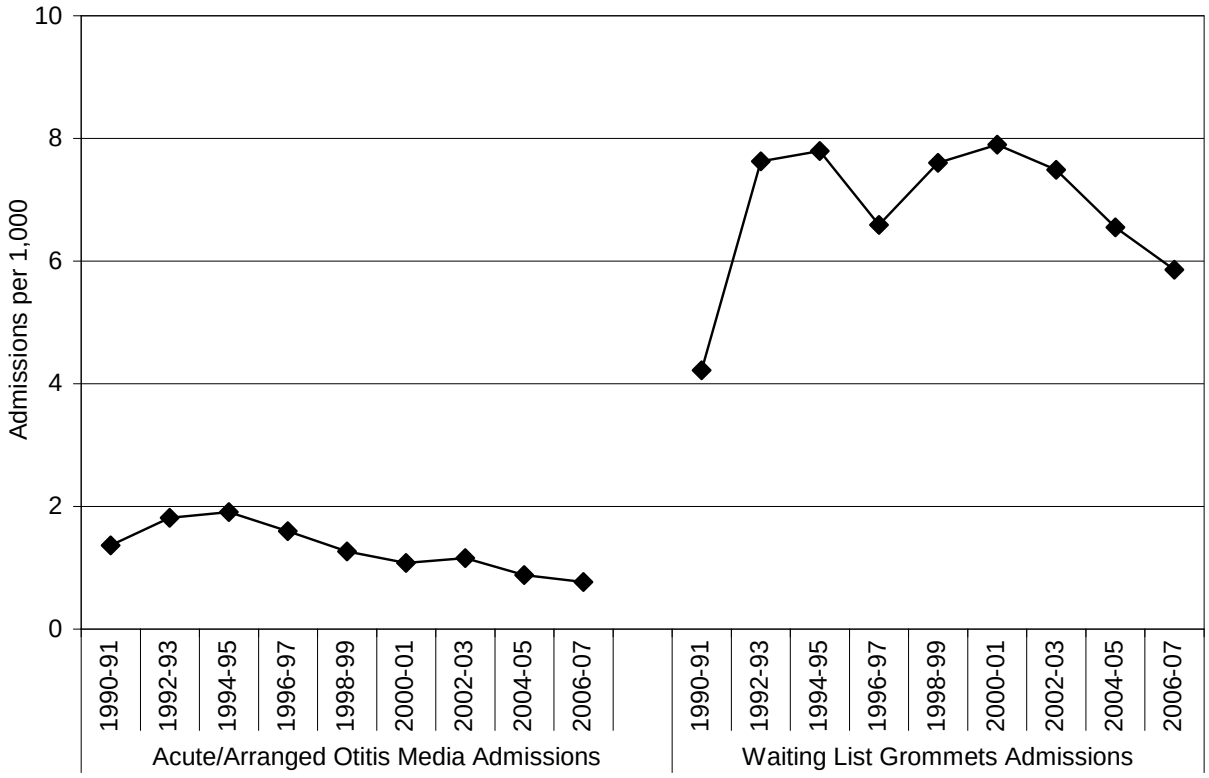
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Å: Denotes Category is included in the Ambulatory Sensitive Hospitalisation coding algorithm; s: small numbers preclude rate calculation.

Table 43. Waiting List Admissions for the Insertion of Grommets by Primary Diagnosis, Any and Sole Pacific vs. New Zealand Children 0-14 Years, 2003-2007

Primary Diagnosis	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	% of Total
Any Pacific				
Å Otitis Media	3,564	712.8	7.25	93.9
Mastoiditis and Related Conditions	141	28.2	0.29	3.7
Perforation/Other Disorders Eardrum	24	4.8	0.05	0.6
Other Diagnoses	67	13.4	0.14	1.8
Total	3,796	759.2	7.72	100.0
Sole Pacific				
Å Otitis Media	2,452	490.4	9.76	93.5
Mastoiditis and Related Conditions	105	21.0	0.42	4.0
Perforation/Other Disorders Eardrum	19	3.8	0.08	0.7
Other Diagnoses	46	9.2	0.18	1.8
Total	2,622	524.4	10.43	100.0
New Zealand				
Å Otitis Media	25,993	5198.6	6.02	94.2
Perforation/Other Disorders Eardrum	635	127.0	0.15	2.3
Eustachian Tube Disorders	165	33.0	0.04	0.6
Other Diagnoses	815	163.0	0.19	3.0
Total	27,608	5521.6	6.39	100.0

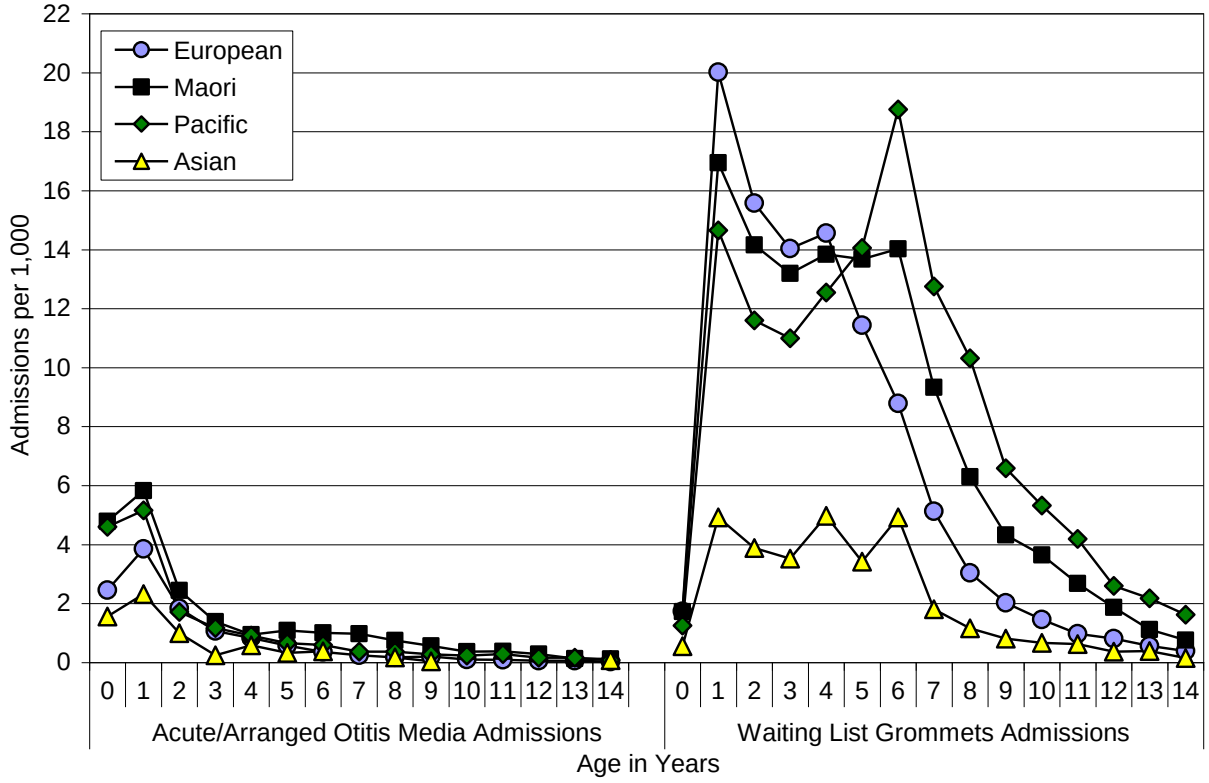
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Å: Denotes Category is included in the Ambulatory Sensitive Hospitalisation coding algorithm.

Figure 49. Acute and Arranged Hospital Admissions for Otitis Media vs. Waiting List Admissions for Grommets in Children 0-14 Yrs, New Zealand 1990-2007



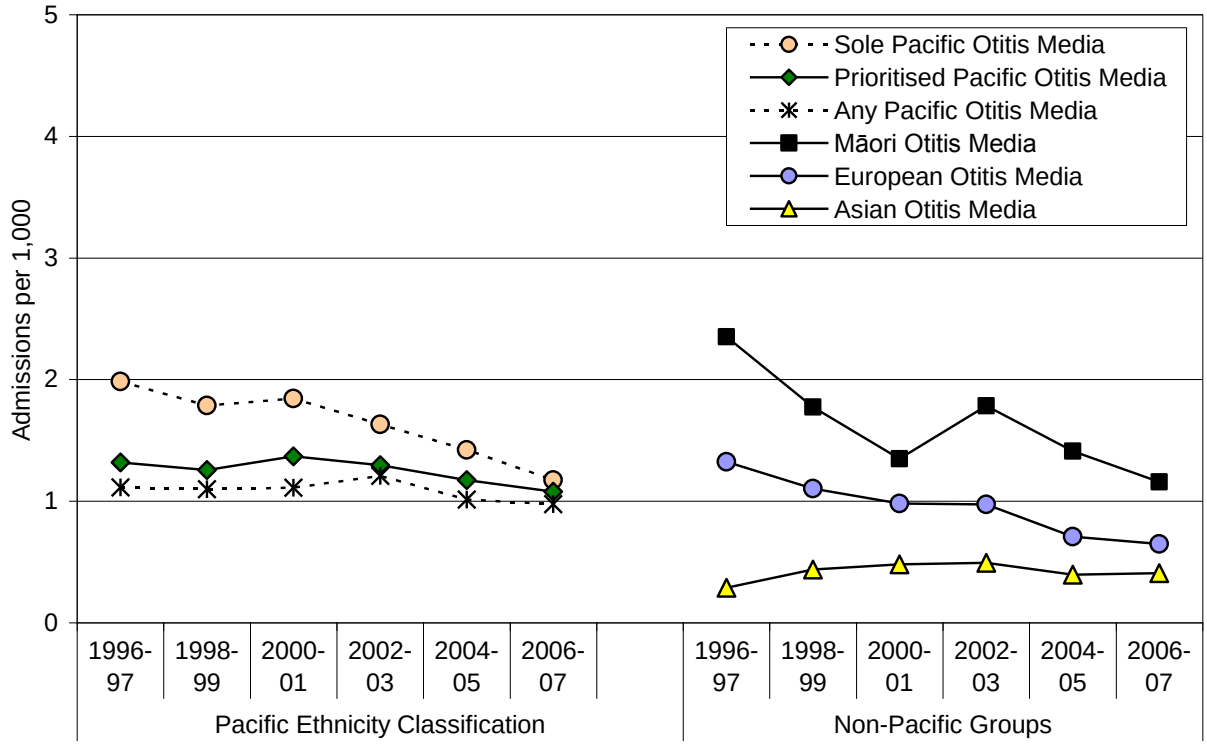
Source: Numerator-National Minimum Dataset; Denominator-Census.

Figure 50. Acute & Arranged Hospital Admissions for Otitis Media vs. Waiting List Admissions for Grommets in Children 0-14 Years by Ethnicity and Age, New Zealand 2003-2007



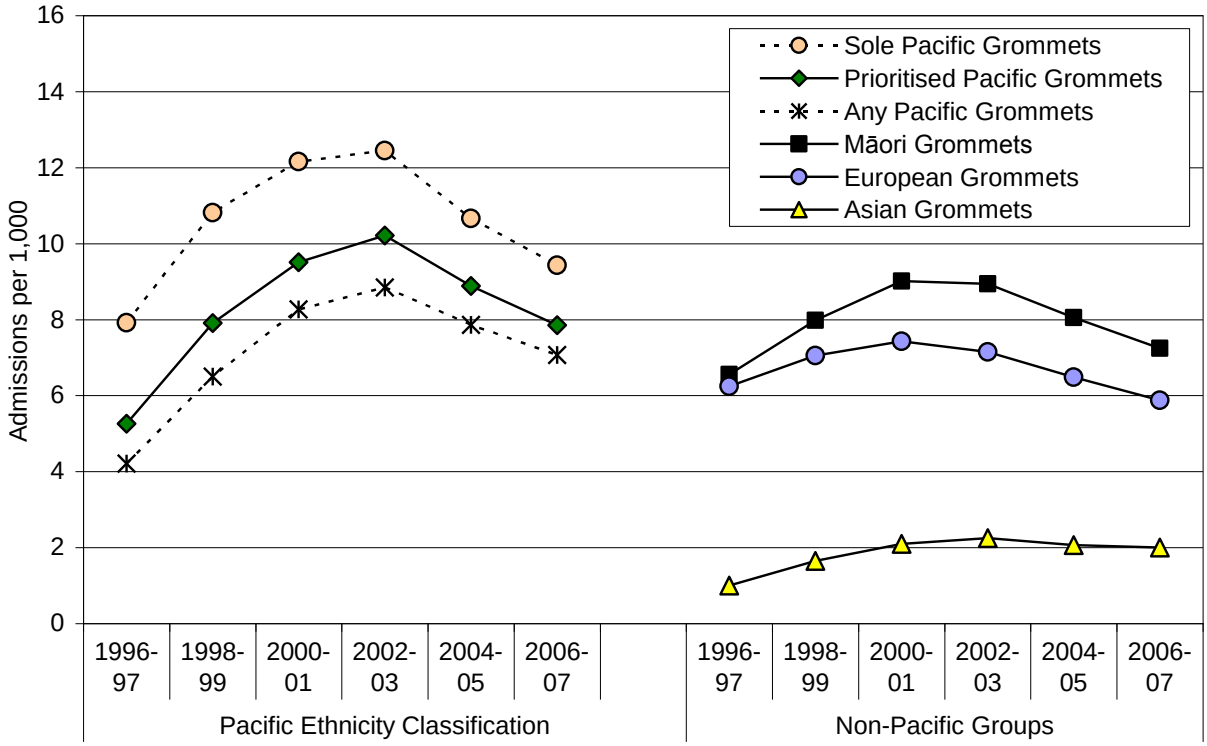
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised

Figure 51. Acute and Arranged Hospital Admissions for Otitis Media in Children 0-14 Years by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only); Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 52. Waiting List Admissions for the Insertion of Grommets in Children 0-14 Years by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset (Waiting List Admissions Only); Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Table 44. Acute and Arranged Hospital Admissions for Otitis Media in Children 0-14 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	0.38	1.00		1-2	0.39	1.00	
2	0.39	1.01	0.82 - 1.26	3-4	0.59	1.52	1.33 - 1.75
3	0.55	1.44	1.18 - 1.75	5-6	0.79	2.03	1.78 - 2.32
4	0.63	1.63	1.34 - 1.98	7-8	1.06	2.73	2.41 - 3.10
5	0.64	1.65	1.36 - 2.01	9-10	1.52	3.92	3.48 - 4.40
6	0.94	2.44	2.04 - 2.93	Prioritised Ethnicity			
7	0.93	2.41	2.01 - 2.89	European	0.74	1.00	
8	1.18	3.08	2.59 - 3.66	Māori	1.43	1.92	1.79 - 2.06
9	1.48	3.85	3.25 - 4.55	Pacific	1.13	1.52	1.37 - 1.69
10	1.55	4.03	3.42 - 4.74	Asian	0.42	0.57	0.48 - 0.67
Gender				Urban / Rural			
Female	0.77	1.00		Urban	0.92	1.00	
Male	1.02	1.32	1.24 - 1.41	Rural	0.74	0.80	0.73-0.88

Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only); Denominator-Census; Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Table 45. Waiting List Admissions for the Insertion of Grommets in Children 0-14 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	3.27	1.00		1-2	3.50	1.00	
2	3.73	1.14	1.06 - 1.22	3-4	4.74	1.36	1.29 - 1.42
3	4.40	1.34	1.25 - 1.44	5-6	6.44	1.84	1.76 - 1.93
4	5.09	1.55	1.45 - 1.66	7-8	8.60	2.46	2.36 - 2.57
5	5.91	1.81	1.69 - 1.93	9-10	8.35	2.39	2.29 - 2.49
6	6.97	2.13	2.00 - 2.27	Prioritised Ethnicity			
7	7.80	2.38	2.24 - 2.54	European	6.35	1.00	
8	9.36	2.86	2.70 - 3.04	Māori	7.85	1.24	1.20 - 1.27
9	8.70	2.66	2.51 - 2.82	Pacific	8.68	1.37	1.32 - 1.42
10	8.05	2.46	2.32 - 2.61	Asian	2.01	0.32	0.29 - 0.34
Gender				Urban / Rural			
Female	5.39	1.00		Urban	6.89	1.00	
Male	7.35	1.36	1.33 - 1.40	Rural	3.60	0.52	0.50-0.54

Source: Numerator-National Minimum Dataset; Denominator-Census; Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted

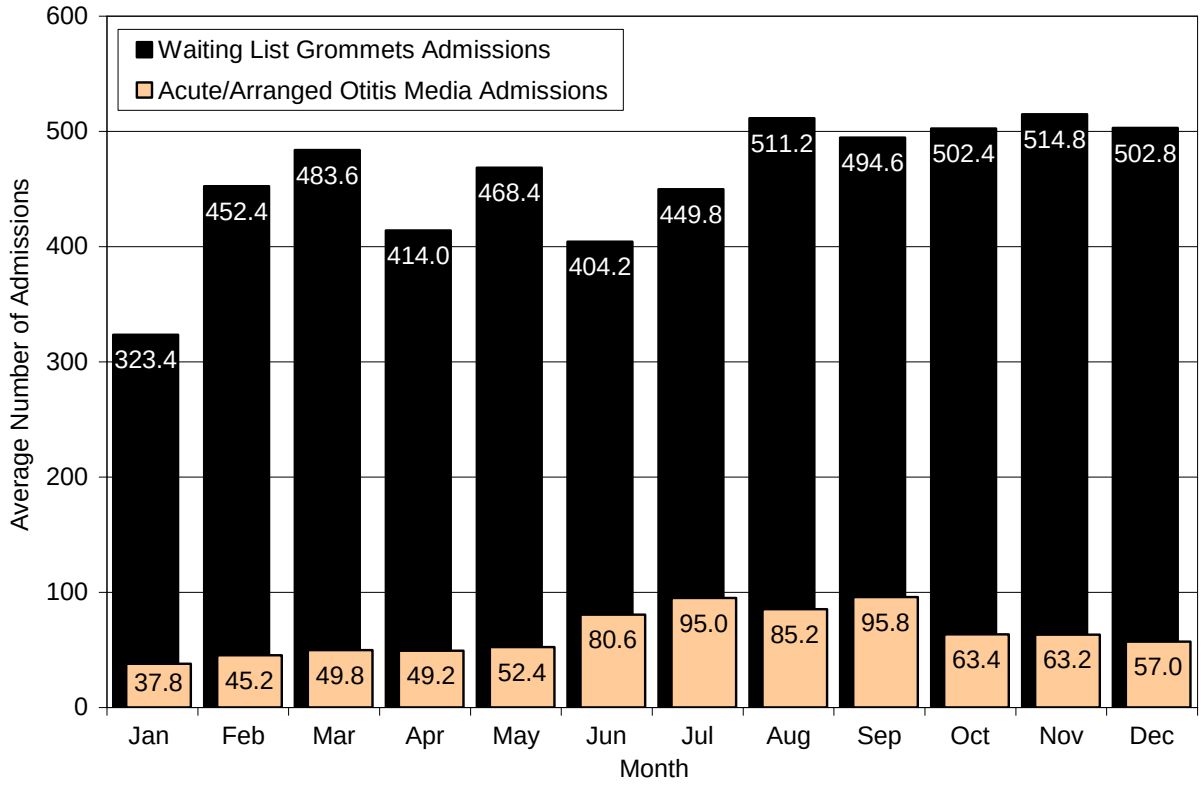
Distribution by Prioritised Ethnicity, NZDep, Gender, and Rural / Urban Location

In New Zealand during 2003-2007, acute / arranged admissions for otitis media were *significantly higher* for Māori > Pacific > European > Asian children, males and those living in more deprived or urban areas (**Table 44**). Similarly, waiting list admissions for the insertion of grommets were *significantly higher* for Pacific > Māori > European > Asian children, males and those living in more deprived or urban areas (**Table 45**) (although these ethnic differences varied markedly with age (**Figure 50**).

Distribution by Season

In New Zealand during 2003-2007, there were no marked seasonal variations in waiting list admissions for the insertion of grommets, although numbers were lowest during January. In contrast, acute / arranged admissions for otitis media tended to be higher during winter and early spring (**Figure 53**).

Figure 53. Average Number of Acute / Arranged Admissions for Otitis Media and Waiting List Admissions for Grommets per Month in Children 0-14 Years, New Zealand 2003-2007



Source: National Minimum Dataset

Hospital Admissions for Otitis Media and the Insertion of Grommets Amongst Pacific Groups in New Zealand

Pacific Group Trends

Acute / Arranged Admissions for Otitis Media: During 1996-2007 (using the Sole / Any classification), acute / arranged admissions for otitis media were similar for Sole Samoan, Tongan and Cook Island Māori children. While admissions for Any Cook Island Māori children were generally lower than for Any Samoan and Tongan children (**Figure 54**), these differences did not reach statistical significance during 2003-2007 (**Table 46**).

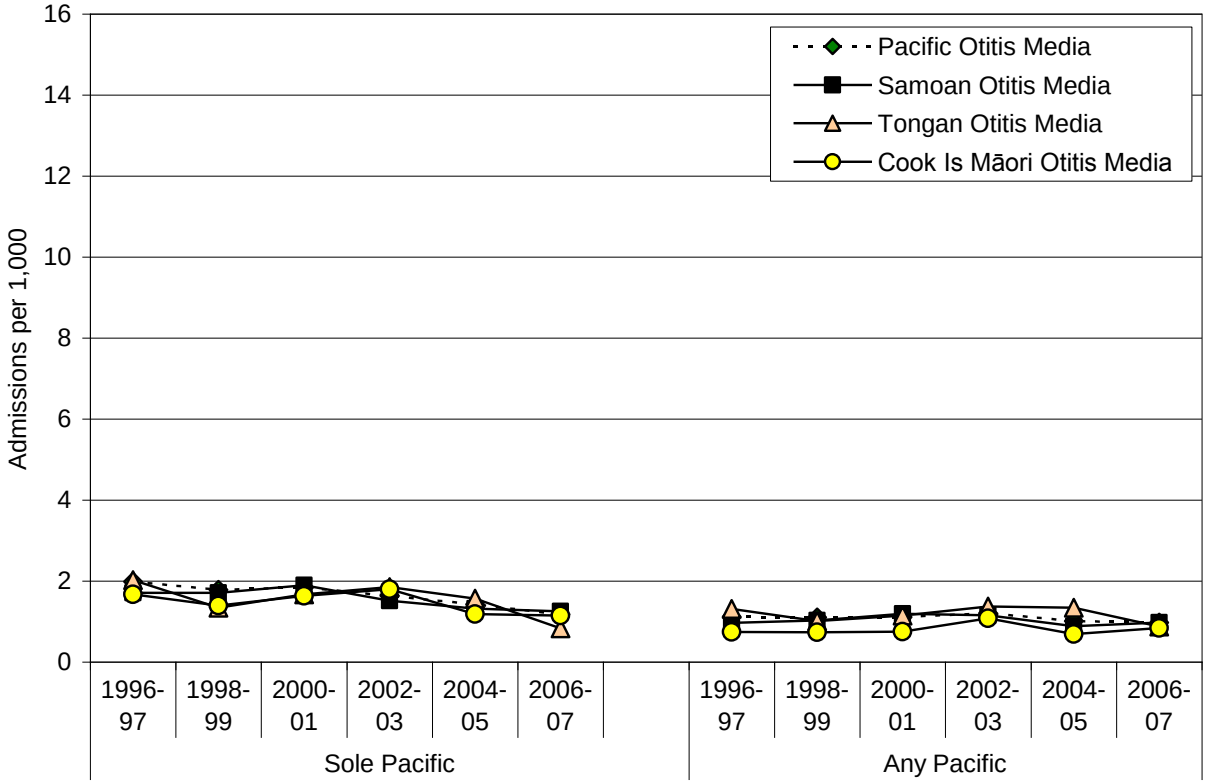
Waiting List Admissions for the Insertion of Grommets: During 1996-2007 (using the Sole / Any classification), waiting list admissions for the insertion grommets were higher for Sole Cook Island Māori than for Sole Tongan or Samoan children, although similar differences were not evident amongst those in the corresponding Any Pacific groups (**Figure 55**).

Distribution by Pacific Group

Acute / Arranged Admissions for Otitis Media: During 2003-2007 (using the Sole / Any classification), acute / arranged admissions for otitis media were *significantly higher* for Sole and Any Samoan, Tongan and Other Pacific children and for Sole Cook Island Māori, Niuean and Tokelauan children than they were for non-Māori non-Pacific children (**Table 46**).

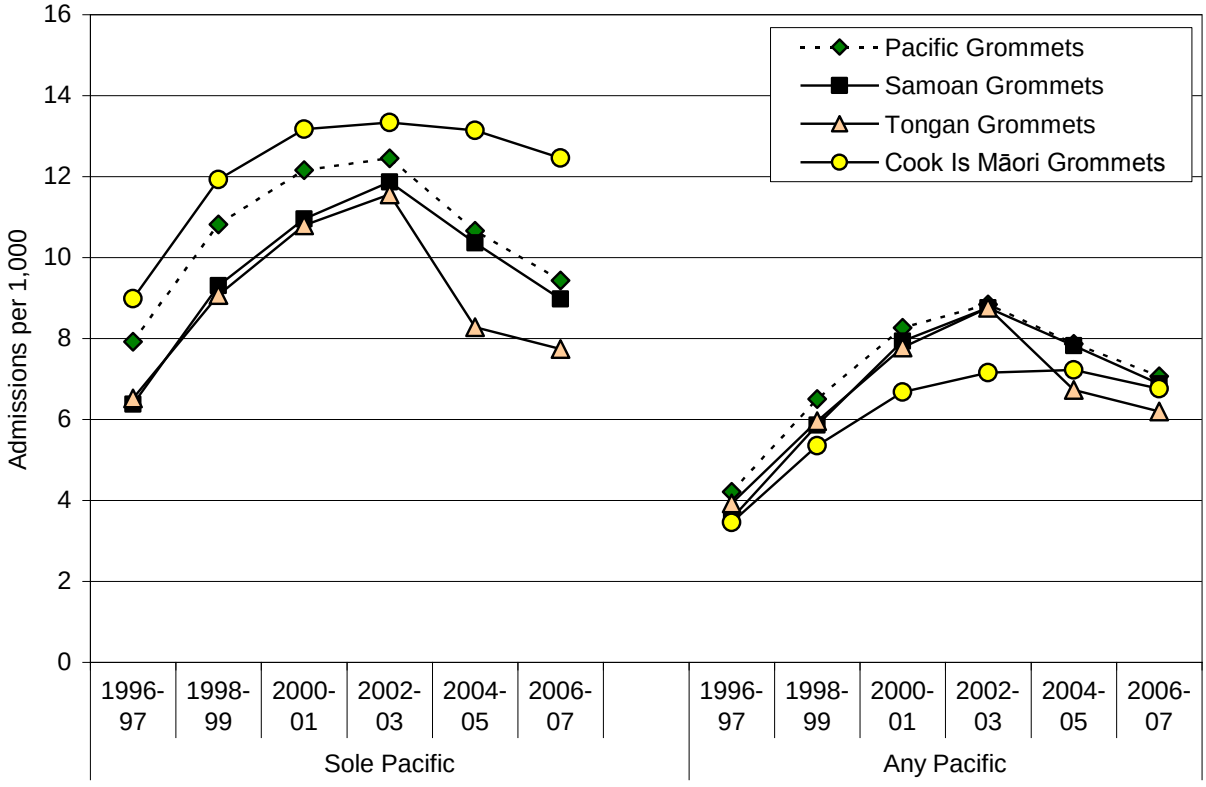
Waiting List Admissions for the Insertion of Grommets: During 2003-2007 (using the Sole / Any classification), waiting list admissions for the insertion of grommets were *significantly higher* for each of the Sole and Any Pacific groups (with the exception of Sole and Any Fijian and Sole Tokelauan children) than they were for non-Māori non-Pacific children. In addition, admissions were *significantly higher* for Sole Cook Island Māori and Niuean children than for Sole Samoan and Tongan children (**Table 46**).

Figure 54. Acute and Arranged Hospital Admissions for Otitis Media in Pacific Children 0-14 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only); Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details

Figure 55. Waiting List Admissions for the Insertion of Grommets in Pacific Children 0-14 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset (Waiting List Admissions Only); Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Table 46. Distribution of Acute / Arranged Hospital Admissions for Otitis Media and Waiting List Admissions for the Insertion of Grommets in Pacific Children 0-14 Years by Pacific Group, New Zealand 2003-2007

Any Pacific										
Pacific Group	Otitis Media (Acute and Arranged Admissions)					Grommets (Waiting List Admissions)				
	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	241	48.2	0.98	1.43	1.25-1.63	1,854	370.8	7.57	1.35	1.29-1.41
Any Tongan	108	21.6	1.05	1.53	1.26-1.85	699	139.8	6.81	1.21	1.12-1.31
Any Cook Island Māori	92	18.4	0.79	1.14	0.93-1.40	829	165.8	7.07	1.26	1.18-1.35
Any Niuean	33	6.6	0.75	1.09	0.77-1.54	297	59.4	6.77	1.21	1.08-1.35
Any Fijian	16	3.2	1.07	1.55	0.95-2.53	83	16.6	5.53	0.98	0.79-1.22
Any Tokelauan	10	2.0	0.71	1.03	0.55-1.92	95	19.0	6.74	1.20	0.98-1.47
Any Other Pacific	20	4.0	1.35	1.96	1.26-3.04	109	21.8	7.35	1.31	1.09-1.58
Any Pacific	499	99.8	1.02	1.47	1.34-1.63	3,796	759.2	7.72	1.38	1.33-1.42
Any Māori	1,421	284.2	1.43	2.07	1.94-2.22	7,818	1,563.6	7.85	1.40	1.36-1.44
Non-Māori Non-Pacific	2,032	406.4	0.69	1.00		16,564	3,312.8	5.61	1.00	
Sole Pacific										
Pacific Group	Otitis Media (Acute and Arranged Admissions)					Grommets (Waiting List Admissions)				
	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	168	33.6	1.34	1.94	1.66-2.27	1,250	250.0	9.95	1.77	1.67-1.88
Sole Tongan	70	14.0	1.16	1.69	1.33-2.14	513	102.6	8.53	1.52	1.39-1.66
Sole Cook Island Māori	52	10.4	1.24	1.80	1.36-2.37	551	110.2	13.12	2.34	2.15-2.54
Sole Niuean	14	2.8	1.58	2.30	1.36-3.88	137	27.4	15.48	2.76	2.33-3.26
Sole Fijian	5	1.0	1.07	1.55	0.64-3.72	20	4.0	4.27	0.76	0.49-1.18
Sole Tokelauan	6	1.2	1.62	2.35	1.06-5.24	43	8.6	11.62	2.07	1.54-2.79
Sole Other Pacific	11	2.2	1.76	2.56	1.42-4.63	83	16.6	13.30	2.37	1.91-2.94
Sole Pacific	331	66.2	1.32	1.91	1.70-2.15	2,622	524.4	10.43	1.86	1.78-1.94
Sole Māori	1,117	223.4	2.61	3.79	3.52-4.07	5,667	1,133.4	13.24	2.36	2.29-2.43
Non-Māori Non-Pacific	2,032	406.4	0.69	1.00		16,564	3,312.8	5.61	1.00	

Source: Numerator-National Minimum Dataset (Acute and Arranged Admissions Only for Otitis Media and Waiting List Admissions Only for Grommets); Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); RR: Rate ratios are compared to the Non-Māori Non-Pacific group and are unadjusted.

Summary

Hearing Screening: In New Zealand during 1993-2006 there was a gradual decline in audiometry failure rates at school entry, with rates falling from 9.7% in 1993, to 6.6% in 2006. While rates for Pacific children also declined (from 14.0% in 1992 to 11.2% in 2006), rates remained higher than for European / Other (1993-2001) and European and Asian (2002-2006) children. Audiometry failure rates for Pacific children were also higher than for Māori children for the majority of this period.

Otitis Media and Grommets: In New Zealand during 2003-2007, otitis media was the most frequent cause of acute / arranged hospital admissions for middle ear and mastoid conditions amongst Any and Sole Pacific children, as well as the most frequent indication for a waiting list admission for the insertion of grommets. During this period, acute / arranged admissions for otitis media reached a peak between 1-2 years of age and thereafter gradually declined, with the age profile being remarkably similar for all ethnic groups. In contrast, waiting list admissions for grommets were highest for European > Māori > Pacific > Asian children during their pre-school years, but became higher for Pacific and Māori children than for European children during the primary school years.

During 2003-2007 (using the Sole / Any classification), acute / arranged admissions for otitis media were *significantly higher* for Sole and Any Samoan, Tongan and Other Pacific children and for Sole Cook Island Māori, Niuean and Tokelauan children than for non-Māori non-Pacific children. Similarly, waiting list admissions for the insertion of grommets were *significantly higher* for each of the Sole and Any Pacific groups (with the exception of Sole and Any Fijian and Sole Tokelauan children) than for non-Māori non-Pacific children. In addition, admissions were *significantly higher* for Sole Cook Island Māori and Niuean children than for Sole Samoan and Tongan children.

Local Policy Documents and Evidence Based Reviews Relevant to the Identification & Management of Otitis Media

In New Zealand there are no policy documents which focus solely on the prevention of otitis media and acquired hearing loss in children. A range of documents however consider approaches to respiratory / infectious diseases and their risk factors more generally, and these have been reviewed in other sections of this report:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 31 on Page 119
2. **Interventions Aimed at Smoking** / **Tobacco Control:** Table 32 on Page 120.
3. **Interventions Aimed at Housing and Household Crowding:** Table 33 on Page 121
4. **Interventions Aimed at Breastfeeding:** Breastfeeding Section on Page 58

In addition, a range of Ministry of Health policy documents consider protocols for hearing screening in this age group. These are considered in **Table 47**, along with a small number of international reviews which consider the most appropriate management for children with otitis media with effusion, and the likely effects of pneumococcal vaccines in preventing otitis media in this age group.

Table 47. Local Policy Documents and Evidence Based Reviews Relevant to the Identification and Management of Otitis Media

Ministry of Health Policy Documents
Ministry of Health. **The B4 School Check: A Handbook for Practitioners.** 2008, Wellington: http://www.MOH.govt.nz/MOH.nsf/pagesmh/8069/$File/b4sc-handbook.pdf During 2008, hearing screening at school entry was replaced with screening at 4-5 years of age as part of the B4 School Check. This Handbook provides advice for those undertaking the B4 School Check, on the protocols to be used for audiometry screening (using the sweep test), as well as the referral criteria and clinical pathways to be followed for those identified as having abnormal tests.
Universal Newborn Hearing Screening Advisory Group. Universal Newborn Hearing Screening for New Zealand 2005; **A Report by the Universal Newborn Hearing Screening Advisory Group to the National Screening Unit.** 2006, Ministry of Health; Wellington. This report, undertaken by the Universal Newborn Hearing Screening Advisory Group (UNHSAG) investigated the possibility of introducing universal newborn hearing screening in New Zealand. This report strongly endorsed the introduction of a screening programme and outlined a proposed model, as well as an early intervention programme.
Ministry of Health. **Child and Youth Health Toolkit.** 2004, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/pagesmh/5411/$File/childandyouthhealthtoolkit.pdf This toolkit is aimed at DHB staff and others wishing to improve child and youth health. Chapter 11 pg (59-64), while now superseded by the B4 School Check screening protocol (above), outlines a range of strategies DHBs might use to address the hearing health needs of children in their regions.
Ministry of Health. **Otitis Media Guidelines**. 2004, Ministry of Health; Wellington. http://www.electiveservices.govt.nz/guidelines/om-national-guidelines.html National guidelines for management of acute otitis media, recurring otitis media and otitis media with effusion.
Ministry of Health. **Well Child-Tamariki Ora. National Schedule Handbook**. 2002, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/ea6005dc347e7bd44c2566a40079ae6f/541c9f741b2d3f60cc256c0b0078eed5/$FILE/Wellchild121102.pdf Until Newborn Hearing Screening becomes universally available, it is likely that the high risk approaches to identifying hearing loss in infancy outlined in this Handbook will need to be continued in many DHBs. The new entrant hearing screening protocols outlined in this document however, have been superseded by the B4 School Check Handbook.
Systematic and Other Reviews from the International Literature
National Collaborating Centre for Women's and Children's Health. **Surgical Management of Otitis Media with Effusion in Children**. 2008. Royal College of Obstetricians and Gynaecologists; London. http://www.nice.org.uk/nicemedia/pdf/CG60fullguideline.pdf The guideline was developed to provide guidance on the appropriate criteria for referral, assessment and surgical management of children <12 years with a suspected diagnosis of Otitis Media with Effusion (OME). The guideline recommends that children with persistent bilateral OME documented over a period of 3 months with a hearing level in the better ear of 25–30 dBHL or worse averaged at 0.5, 1, 2 and 4 kHz (or equivalent dBA where dBHL not available) should be considered for surgical intervention.
Leach A, Morris P. **Antibiotics for the Prevention of Acute and Chronic Suppurative Otitis Media in Children**. Cochrane Database of Systematic Reviews, 2006. Issue 4. This review found that long-term antibiotics (over at least six weeks) almost halved the risk of further infections. There was insufficient information to determine if antibiotics reduced acute otitis media with perforation, chronic suppurative otitis media, or improved long-term outcomes. Antibiotics were not a frequent cause of side effects (e.g. allergic reactions, diarrhoea), but their potential side effects, cost and inconvenience must be balanced against their benefits. Antibiotic resistance from the long-term use is also an issue which should be considered, particularly for children with recurring infections.

Lous J, Burton M, Felding J, et al Grommets **(Ventilation Tubes) for Hearing Loss Associated with Otitis Media With Effusion In Children**. Cochrane Database of Systematic Reviews, 2005. Issue 1.

The insertion of grommets (ventilation or tympanostomy tubes) is a surgical treatment option commonly used to improve hearing in children with glue ear. This review found that the benefits of grommets in children appear small, with any effects on hearing diminishing during the first year (most grommets fall out after this time). There was no evidence that grommets helped with long term speech or language development. The review also found that potentially adverse effects on the tympanic membrane were common after grommet insertion. The authors concluded that watchful waiting would appear to be an appropriate management strategy for most children with glue ear.

Straetemans M, Sanders E, Veenhoven R, et al. **Pneumococcal Vaccines for Preventing Otitis Media**. Cochrane Database of Systematic Reviews 2004, Issue 1.

This review concluded that based on the available results of the effectiveness of pneumococcal vaccination for the prevention of Acute Otitis Media (AOM), the large scale use of pneumococcal polysaccharide and conjugate vaccination for this specific indication is not yet recommended. So far, pneumococcal conjugate vaccinations are not indicated in the management of recurrent AOM in toddlers and older children. The authors hope that the results of ongoing trials of 9 and 11 valent conjugate vaccines will provide more information as to whether pneumococcal vaccines are more effective in specific high-risk populations (e.g. infants, older children with recurrent AOM or immunodeficiency).

Lower Respiratory Tract Conditions

Bronchiolitis

Introduction

Bronchiolitis is an acute viral infection of the lower respiratory tract commonly caused by the respiratory syncitial virus (RSV), although parainfluenza, influenza and other viruses have also been implicated. RSV is transmitted by contact with infected nasal secretions and less frequently, by aerosol spread. Its incubation period is 2-8 days, and following a prodromal phase, acute illness usually lasts 3-7 days, with gradual recovery over a 1-2 week period. Symptoms include runny nose, cough, low grade fever, expiratory wheeze and respiratory distress. Treatment is usually supportive, with severely affected infants being admitted to hospital for oxygen and fluid supplementation [198].

RSV is common, with overseas estimates suggesting >50% of infants are infected during the first year of life and >80% by the age of 2 years. Epidemics occur during winter months, and although there are only 2 major RSV strains (A and B), numerous genotypes, subtypes and frequent shifts in the dominant strain mean that infants may remain susceptible to reinfection from year to year, or even within the same season. Of those infected, 1-2% require hospital admission [198], with the case fatality rate of those admitted being around 2% [199]. Risk of hospital admission is increased by factors such as male sex, young age (<6 months), birth during the first half of the RSV season, overcrowding, the presence of siblings and attendance at day care [200]. In addition, socioeconomic disadvantage, lack of breastfeeding and maternal smoking have been implicated in a number of studies [199].

In New Zealand, RSV bronchiolitis hospitalisations are higher for Pacific and Māori infants than for European infants, although one recent review noted that these differences could only be partially accounted for by known risk factors such as maternal smoking during pregnancy, the deprivation status of the area in which the infant lived and low birth weight (the authors acknowledged however the limitations of using the NZ Deprivation Index to adjust for socioeconomic status in this analysis) [201].

The following section explores bronchiolitis rates amongst Pacific infants in New Zealand using information from the National Minimum Dataset and Mortality Collection. The section concludes with a review of policy and evidence based review documents which consider interventions to address bronchiolitis at the population level.

Data Source and Methods

Definition

Hospital Admissions and Deaths due to Bronchiolitis in Infants < 1 Year of Age

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions of infants < 1 year of age with a primary diagnosis of Bronchiolitis (ICD-9 466.1; ICD-10 J21)

Deaths Numerator: National Mortality Collection: Deaths in infants < 1 year of age where the main underlying cause of death (clinical code) was Bronchiolitis (ICD-9 466.1; ICD-10 J21)

Denominator: Birth Registration Dataset

Notes on Interpretation

Note 1*: Appendix 4: The National Minimum Dataset* outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category

Admissions: Proxy B-C; Mortality: Ideal B

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1990-2007, bronchiolitis admissions in infants <1 year increased, reached a peak in 2002-03 and thereafter declined. Despite this, mortality during 1990-2005 remained relatively static (**Figure 56**).

Distribution by Age

In New Zealand, bronchiolitis is predominantly a disease of infancy, with the majority of hospital admissions during 2003-2007 and deaths during 2001-2005 occurring during the first year of life, although a small number also occurred between 1-2 years of age (**Figure 57**).

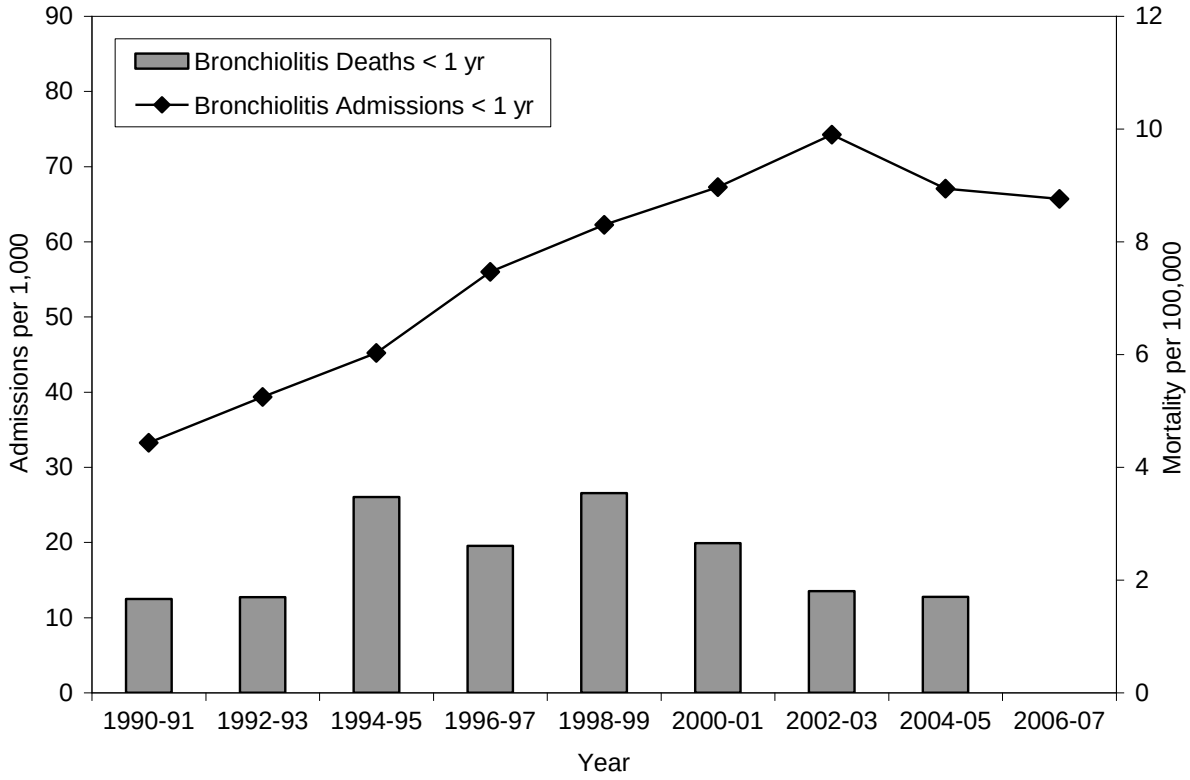
Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

In New Zealand during 2003-2007, hospital admissions for bronchiolitis were *significantly higher* for Pacific > Māori > European > Asian infants, males and those living in urban or deprived areas (**Table 48**). Similar ethnic differences were seen throughout 1996-2007, with admission rates during this period being consistently higher for Sole than for Any Pacific infants (**Figure 58**).

Distribution by Season

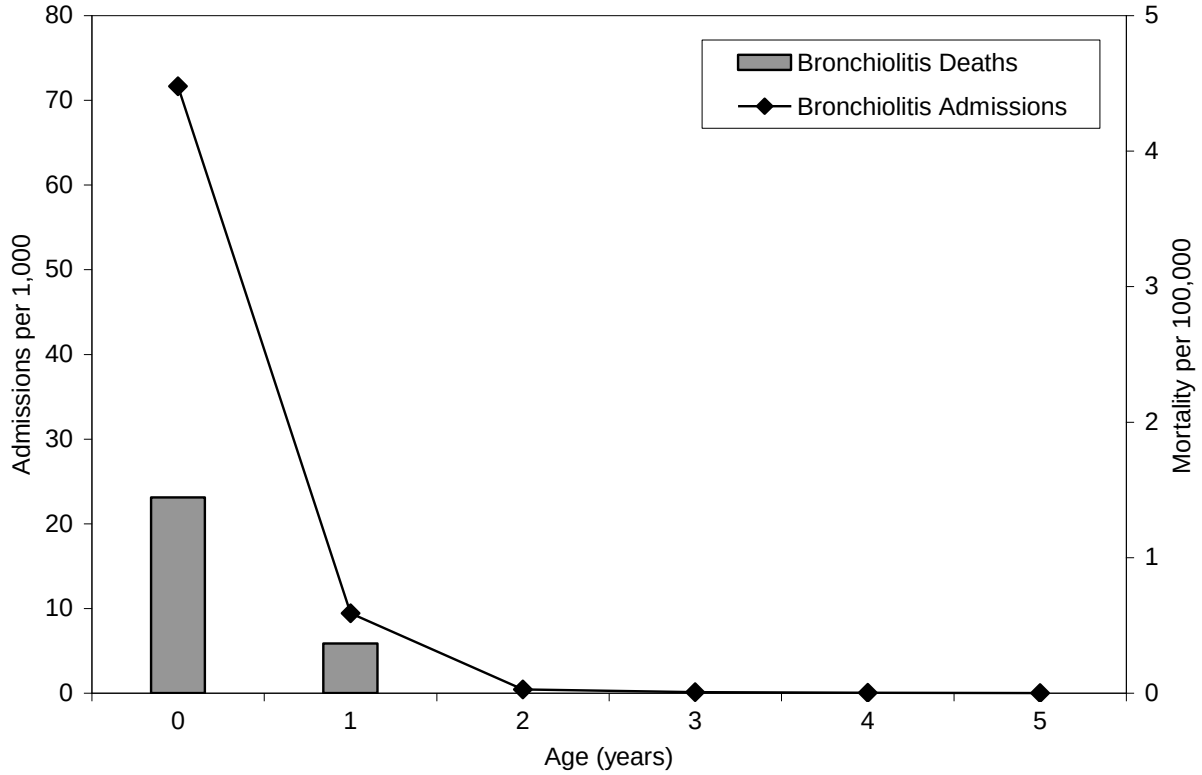
In New Zealand during 2003-2007, bronchiolitis admissions in infants <1 year were highest during late winter and early spring (**Figure 59**).

Figure 56. Hospital Admissions (1990-2007) and Deaths (1990-2005) due to Bronchiolitis in New Zealand Infants <1 Year of Age



Source: Numerators-National Minimum Dataset & Mortality Collection; Denominator-Birth Registration Dataset. Mortality Data for 2006-07 unavailable

Figure 57. Hospital Admissions (2003-2007) and Deaths (2001-2005) due to Bronchiolitis in New Zealand Children 0-5 Years by Age



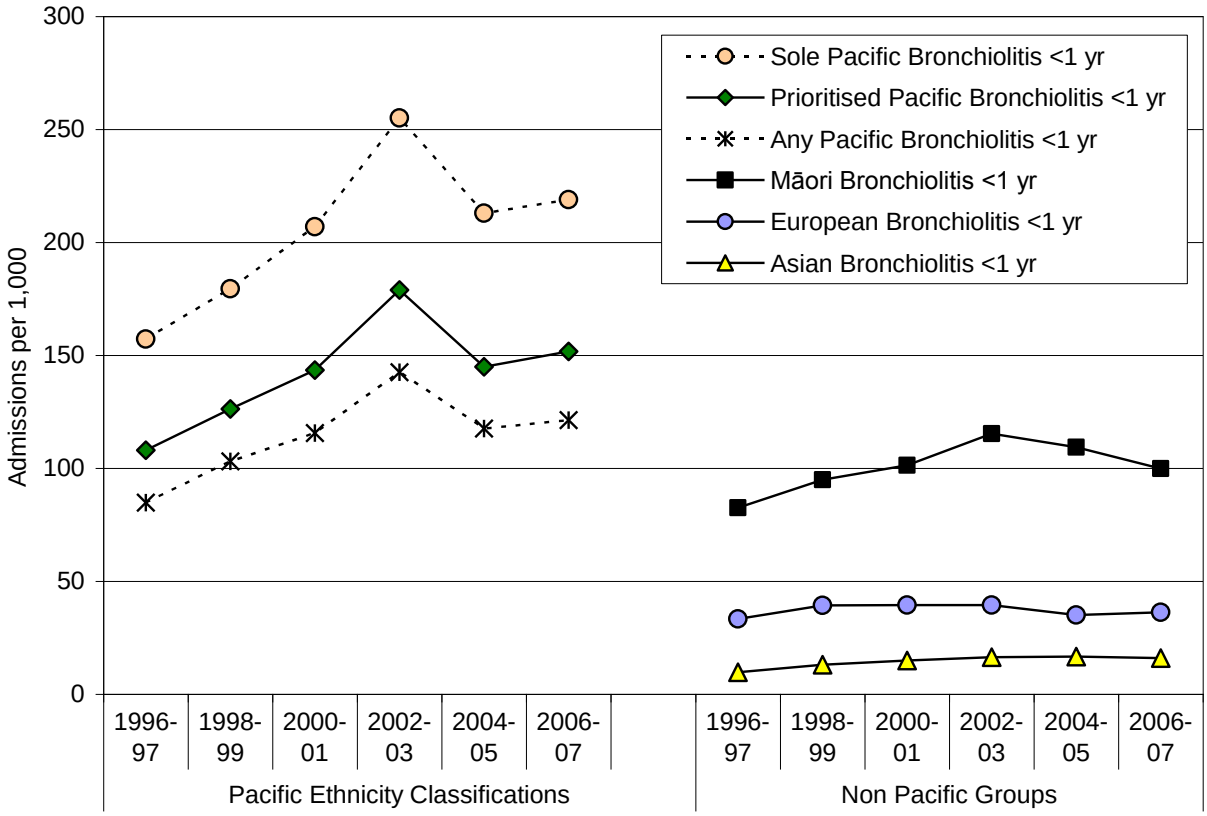
Source: Numerators-National Minimum Dataset & Mortality Collection; Denominator-Birth Registration Dataset

Table 48. Risk Factors for Hospital Admissions due to Bronchiolitis in Infants <1 Year, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	24.66	1.00		1-2	26.20	1.00	
2	27.64	1.12	1.00 - 1.25	3-4	33.29	1.27	1.18 - 1.37
3	31.56	1.28	1.15 - 1.43	5-6	47.10	1.80	1.68 - 1.92
4	34.81	1.41	1.27 - 1.57	7-8	70.73	2.70	2.54 - 2.87
5	42.93	1.74	1.57 - 1.93	9-10	124.20	4.74	4.47 - 5.03
6	50.57	2.05	1.86 - 2.26	Prioritised Ethnicity			
7	65.06	2.64	2.40 - 2.90	European	35.66	1.00	
8	75.28	3.05	2.79 - 3.34	Māori	106.00	2.97	2.88 - 3.07
9	101.85	4.13	3.78 - 4.51	Pacific	153.57	4.31	4.15 - 4.47
10	143.69	5.83	5.35 - 6.35	Asian	16.45	0.46	0.42 - 0.51
Gender				Urban / Rural			
Female	53.11	1.00		Urban	71.61	1.00	
Male	80.70	1.52	1.48 - 1.56	Rural	37.42	0.52	0.50 - 0.55

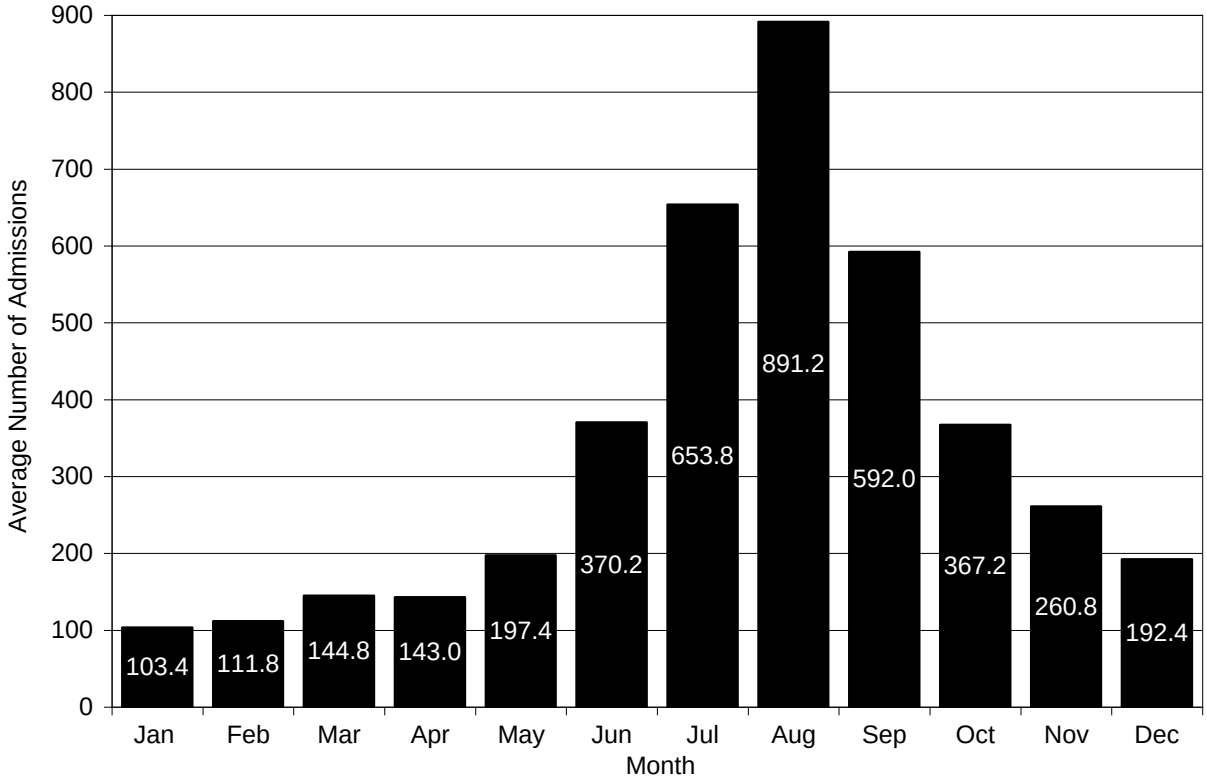
Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset; Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Figure 58. Hospital Admissions for Bronchiolitis in Infants <1 Year by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 59. Average Number of Hospital Admissions for Bronchiolitis in Infants <1 Year per Month, New Zealand 2003-2007



Source: Numerator-National Minimum Dataset.

Bronchiolitis Admissions Amongst Pacific Groups in New Zealand

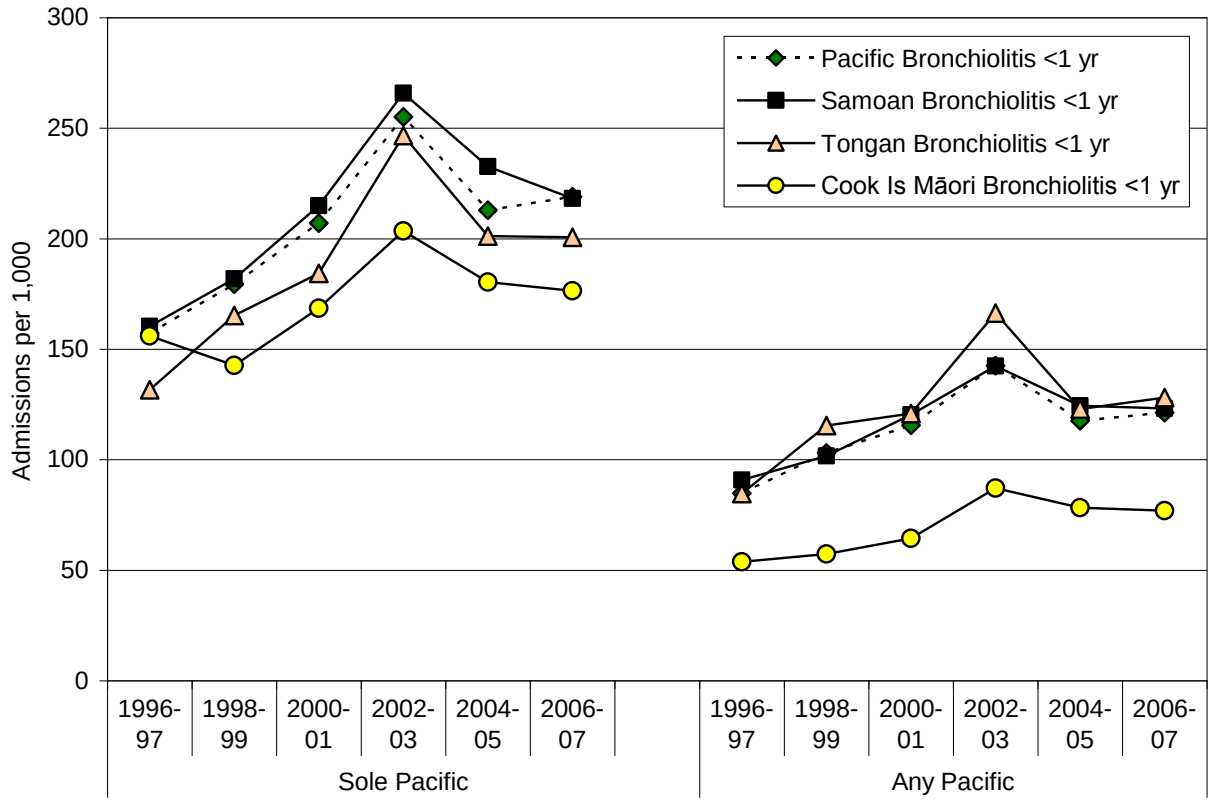
Pacific Group Trends

During 1996-2007 (using the Sole / Any classification), bronchiolitis admissions were generally higher for Samoan and Tongan infants than for Cook Island Māori infants, with these differences being most marked for those in the Any Pacific groups (**Figure 60**).

Distribution by Pacific Group

During 2003-2007 (using the Sole / Any classification), bronchiolitis admissions for Pacific infants were *significantly higher* than for non-Māori non-Pacific infants in each of the Sole and Any Pacific Groups. Within the Any Category, admissions were *significantly higher* for Tongan and Samoan infants than for Cook Island Māori, Niue, Fijian and 'Other' Pacific infants. Within the Sole Category, admissions were *significantly higher* for Niue, Samoan and Tongan infants than for Cook Island Māori, Fijian and Other Pacific infants (**Table 49)**.

Figure 60. Hospital Admissions for Bronchiolitis in Pacific Infants <1 Year by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset; Ethnicity assigned using Any / Sole Classification (see page 9 for details)

Table 49. Distribution of Hospital Admissions for Bronchiolitis in Pacific Children <1 Year by Pacific Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	2,924	584.8	127.52	3.82	3.66-3.98
Any Tongan	1,339	267.8	133.04	3.98	3.77-4.21
Any Cook Island Māori	841	168.2	78.16	2.34	2.18-2.51
Any Niuean	407	81.4	103.09	3.09	2.81-3.39
Any Fijian	67	13.4	46.56	1.39	1.10-1.76
Any Tokelauan	118	23.6	102.97	3.08	2.59-3.66
Any Other Pacific	144	28.8	98.50	2.95	2.52-3.45
Any Pacific	5,583	1,116.6	123.27	3.69	3.56-3.82
Any Māori	9,167	1,833.4	106.00	3.17	3.08-3.27
Non-Māori Non-Pacific	6,037	1,207.4	33.40	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	2,350	470.0	234.65	7.02	6.73-7.33
Sole Tongan	1,060	212.0	210.28	6.30	5.93-6.68
Sole Cook Island Māori	515	103.0	180.01	5.39	4.96-5.85
Sole Niuean	210	42.0	382.51	11.45	10.27-12.77
Sole Fijian	23	4.6	85.82	2.57	1.74-3.80
Sole Tokelauan	62	12.4	229.63	6.87	5.52-8.57
Sole Other Pacific	113	22.6	165.45	4.95	4.18-5.87
Sole Pacific	4,399	879.8	223.30	6.69	6.45-6.93
Sole Māori	7,452	1,490.4	226.25	6.77	6.56-6.99
Non-Māori Non-Pacific	6,037	1,207.4	33.40	1.00	

Source: Numerator-National Minimum Dataset; denominator-Census Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate ratios are compared to the Non-Māori Non-Pacific group and are unadjusted.

Summary

In New Zealand during 1990-2007, bronchiolitis admissions in infants <1 year increased, reached a peak in 2002-03 and thereafter declined. Despite this, mortality during 1990-2005 remained relatively static. When broken down by age, the majority of bronchiolitis admissions and deaths occurred during the first year of life, although a small number also occurred between 1-2 years of age. During 2003-2007, bronchiolitis admissions were also *significantly higher* for Pacific > Māori > European > Asian infants, males and those in urban or deprived areas.

During 2003-2007 (using the Sole / Any classification), bronchiolitis admissions for Pacific infants were *significantly higher* than for non-Māori non-Pacific infants in each of the Sole and Any Pacific Groups. Within the Any Category, admissions were *significantly higher* for Tongan and Samoan infants than for Cook Island Māori, Niue, Fijian and 'Other' Pacific infants. Within the Sole Category, admissions were *significantly higher* for Niue, Samoan and Tongan infants than for Cook Island Māori, Fijian and Other Pacific infants.

Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Bronchiolitis

In New Zealand there are no policy documents which focus solely on the prevention of bronchiolitis in infants. A range of documents however, consider approaches to respiratory / infectious diseases and their risk factors more generally, and these have been reviewed in other sections of this report:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 31 on Page 119
2. **Interventions Aimed at Smoking** / **Tobacco Control:** Table 32 on Page 120.
3. **Interventions Aimed at Housing and Household Crowding:** Table 33 on Page 121
4. **Interventions Aimed at Breastfeeding:** Breastfeeding Section on Page 58

In addition, a number of evidence based / other reviews consider the most effective approaches to the prevention of bronchiolitis, and these are briefly summarised in **Table 50**.

Table 50. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Bronchiolitis

Ministry of Health Policy Documents
In New Zealand there are no policy documents which focus solely on the prevention of Bronchiolitis, although a range of documents consider the prevention of infectious and respiratory diseases more generally (see links above)
Systematic / Other Reviews from the International Literature and Other Relevant Publications
Wang E, Tang N. **Immunoglobulin for Preventing Respiratory Syncitial Virus Infection**. Cochrane Database of Systematic Reviews 2006, Issue 3. Respiratory Syncitial Virus (RSV) is associated with increased morbidity in premature infants and those with congenital heart disease. Because lower rates of disease occur immediately after birth (presumably due to transmission of maternal antibody), and because animal studies demonstrate protection from pneumonia after administration of immune globulin (IG), the efficacy of passive prophylaxis in premature infants has been studied. This review found that RSVIG is effective in preventing RSV hospitalisations and admission to ICU, but not in preventing mechanical ventilation. There was a non-significant trend towards a higher mortality in children given RSVIG.
Harkensee C. Brodlie M. Embleton N, et al. **Passive Immunisation of Preterm Infants with Palivizumab Against RSV Infection**. Journal of Infection, 2006. 52(1):2-8. Palivizumab is an antibody used for preventing RSV infection. This study reviewed the evidence of its efficacy, safety and cost-effectiveness and found that the only randomised controlled trial of its use in preterm infants demonstrated clinical benefit and a favourable safety profile. Other studies however did not suggest that the costs saved in terms of hospitalisation, outweighed the costs of immunisation for the recommended indications. There was also controversy about which groups to include in immunisation programmes and analyses of cost-effectiveness were complicated by variations in incidence, hospital admission and ventilation rates, and health care costs in different health systems. Despite their implicit weakness, these studies do not currently support the widespread use of palivizumab and thus, in the absence of high quality cost-benefit analysis, the authors currently recommend the use of palivizumab only in infants at high risk of severe bronchiolitis, such as those with active chronic lung disease of prematurity.
American Academy of Pediatrics Subcommittee on Diagnosis and Management of Bronchiolitis. **Diagnosis and Management of Bronchiolitis.** Pediatrics, 2006. 118(4):1774-93.. This evidence based review focuses on the diagnosis and management of bronchiolitis and makes a series of recommendations regarding its prevention including the use using Palivizumab, the control of nosocomial infections, the encouragement of breastfeeding and the avoidance of cigarette smoke.
Best Practice Evidence Based Guideline. **Wheeze and Chest Infection in Children Under One**. 2005. Paediatric Society of New Zealand. This guideline provides guidance for the clinical management of wheeze or chest infections in children under the age of one year.

Paes BA. **Current Strategies in the Prevention of Respiratory Syncitial Virus Disease**. Paediatric Respiratory Reviews, 2003. 4(1):21-7.

This review summarises strategies to prevent RSV infection. In the context of in-hospital transmission, it recommends a focus on hand-washing, the education of staff about RSV spread and the use of masks and gowns when in direct contact with infected individuals. The review also recommends educating parents with high-risk infants on the importance of preventive strategies (e.g. avoiding crowded areas in RSV season, individuals with respiratory infections, cigarette smoke, and day-care facilities). It also reviews the problems associated with developing a RSV vaccine, and the use of passive immunisation with Palivizumab.

The Asthma and Respiratory Foundation of New Zealand. **Trying to Catch Our Breath: The Burden of Preventable Breathing Diseases in Children and Young People**, 2006. I. Asher and C. Byrnes, Editors. 2006: Wellington.

This review of the burden of avoidable respiratory disease in New Zealand children specifically considers bronchiolitis on pages 40-46. Strategies for prevention include decreased exposure to cigarette smoke and breastfeeding, with the role of Palivizumab also being discussed.

Å Asthma

Introduction

Asthma is a chronic inflammatory disorder, which causes narrowing of the airways in the lower respiratory tract as a result of bronchial smooth muscle constriction, swelling, inflammation and mucus production. Episodic airflow obstruction leads to symptoms such as shortness of breath, wheezing, prolonged expiration and an irritative cough. Attacks in children are most commonly triggered by viral infections, but may also be associated with hypersensitivity to substances such as pollen, mould, house dust mite, foods, animal dander, cigarette smoke, chemicals or drugs. Asthma may also be triggered by exercise, exposure to cold air, or psychological stress [202].

The prevalence of asthma in New Zealand is among the highest reported worldwide [203], with 25% of children aged 6-7 years and 30% of adolescents 13-14 years reporting asthma symptoms in one recent survey [204]. While asthma prevalence is thought to be highest amongst Māori > European > Pacific children, symptom severity is highest amongst Māori and Pacific children [205]. Ethnic disparities have also been reported in hospital admission rates, with admissions for Māori children being higher than for non-Māori children, particularly in rural areas [206]. In addition, recent research suggests that the prevalence of asthma symptoms amongst Pacific children residing in New Zealand may be higher than for children residing in the Pacific, potentially suggesting that migration may lead to an altered risk of asthma, as the result of exposure to different environments [207]. From a public health perspective however, while addressing issues such as exposure to tobacco smoke, use of preventer medication and access to primary health care may assist in reducing disparities in the severity of asthma symptoms / hospital admission rates [205], it remains unclear what population level interventions will be of value in reducing the underlying prevalence of asthma in New Zealand's children and young people.

The following section explores asthma rates for Pacific children and Young people in New Zealand using information from the National Minimum Dataset and Mortality Collection. The section concludes with a review of policy and evidence based review documents which consider interventions to address asthma at the population level.

Data Source and Methods

Definition

Hospital Admissions and Deaths due to Asthma in Children and Young People Aged 0-24 Years

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions of children and young people (0-24 years) with a primary diagnosis of Asthma (ICD-9 493; ICD-10 J45-46)
Deaths Numerator: National Mortality Collection: Deaths in children and young people (0-24 years) where the main underlying cause of death (clinical code) was Asthma (ICD-9 493; ICD-10 J45-46)
Denominator: NZ Census

Notes on Interpretation

Note 1*: Appendix 4: The National Minimum Dataset* outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category

Admissions: Proxy B-C; Mortality: Ideal B

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1990-2007, hospital admissions for asthma in young people declined. While admissions for children also declined during 1990-2003, an upswing in rates was evident during 2004-2007. Despite this, mortality during 1994-2005 remained relatively static (**Figure 61**).

Distribution by Age

In New Zealand during 2003-2007, asthma admissions were highest for children <5 years, while mortality during 2001-2005 was highest for those in their late teens and early twenties (**Figure 62**).

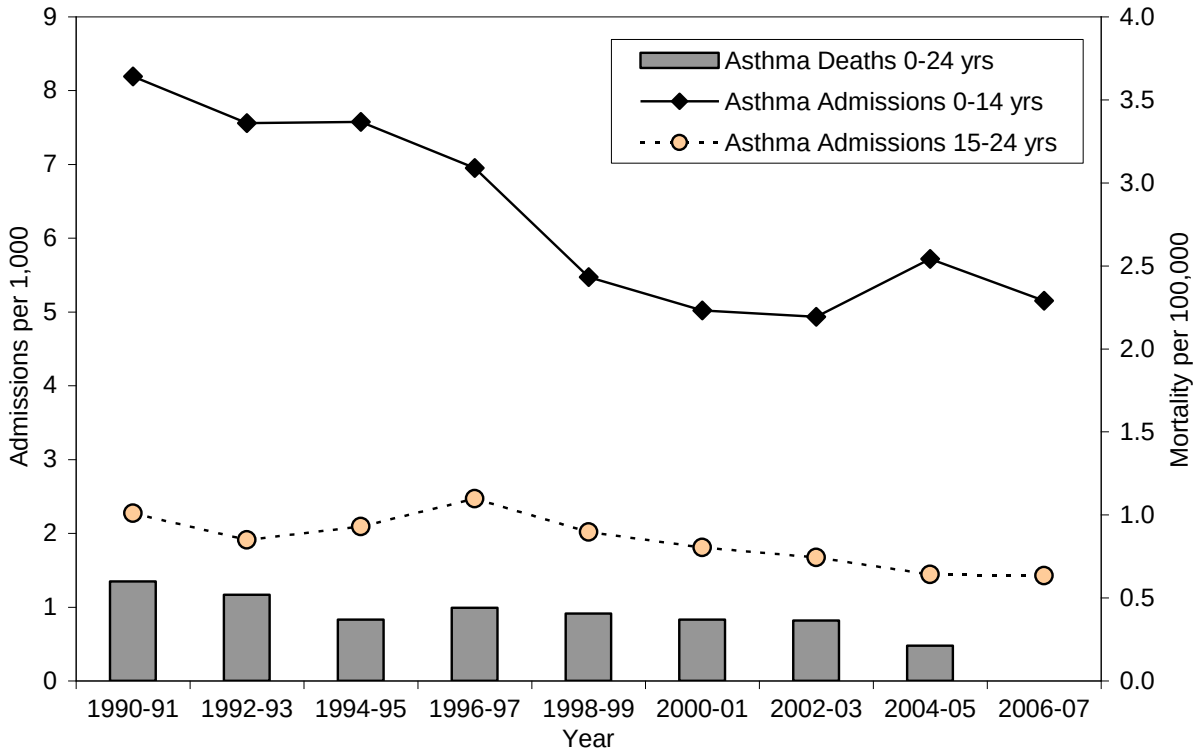
Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

In New Zealand during 2003-2007, asthma admissions were *significantly higher* for Pacific > Māori > Asian > European children, males and those living in urban or deprived areas (**Table 51**). Similarly, asthma admissions were higher for Pacific > Māori > European and Asian children and young people for the majority of 1996-2007, with rates for Sole Pacific children and young people being higher than for Any Pacific children and young people throughout this period (**Figure 63**).

Distribution by Season

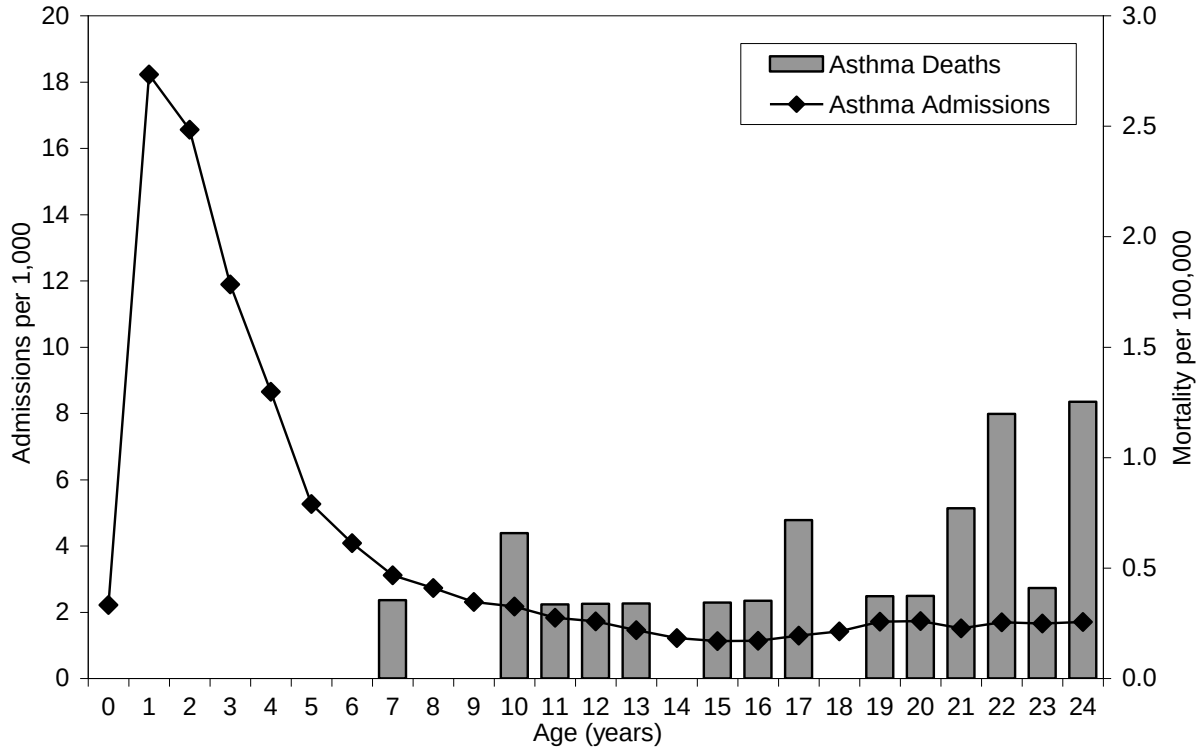
In New Zealand during 2003-2007, hospital admissions for asthma in children and young people were lowest during January (**Figure 64**).

Figure 61. Hospital Admissions (1990-2007) and Deaths (1990-2005) due to Asthma in New Zealand Children and Young People 0-24 Years



Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census. Note: Mortality data unavailable for 2006-07.

Figure 62. Hospital Admissions (2003-2007) and Deaths (2001-2005) due to Asthma in New Zealand Children and Young People 0-24 Years by Age



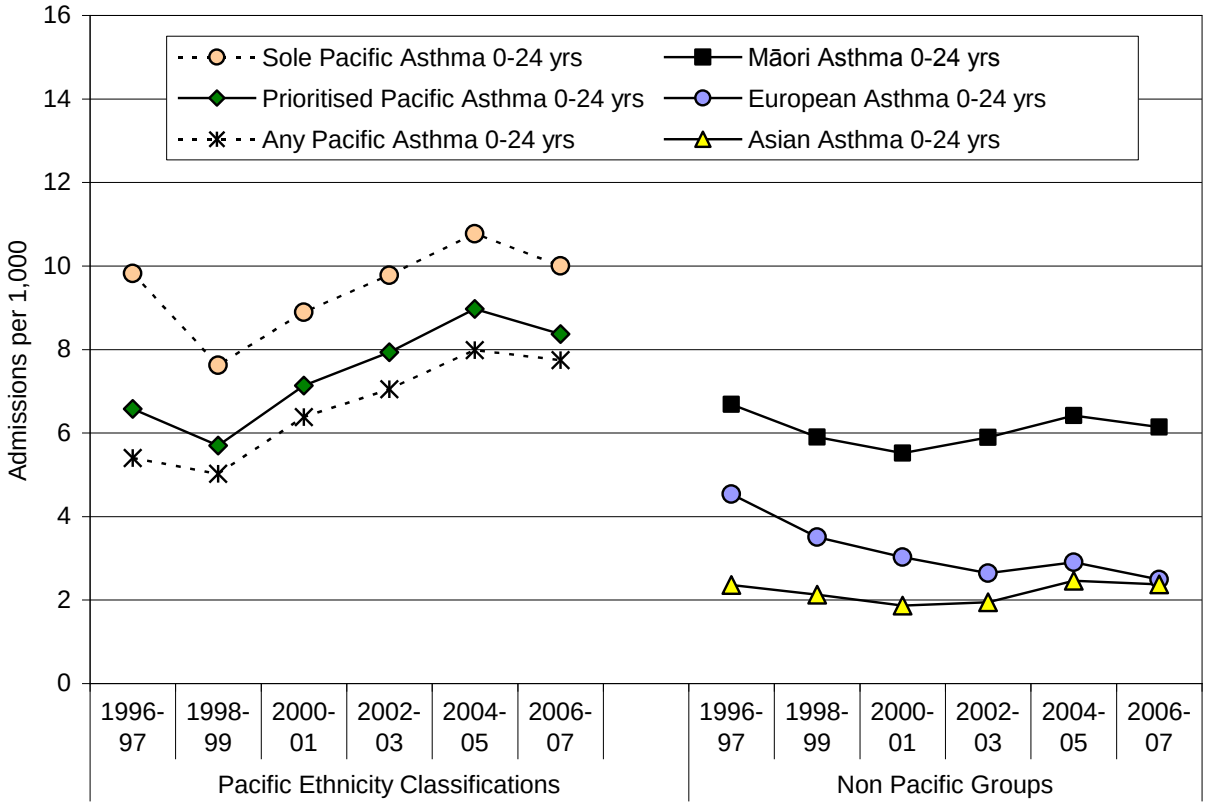
Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census

Table 51. Risk Factors for Hospital Admissions due to Asthma in Children 0-14 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	2.60	1.00		1-2	2.59	1.00	
2	2.59	1.00	0.92 - 1.08	3-4	3.48	1.34	1.27 - 1.42
3	3.06	1.18	1.09 - 1.28	5-6	4.76	1.84	1.74 - 1.93
4	3.91	1.51	1.40 - 1.63	7-8	6.96	2.69	2.56 - 2.82
5	4.15	1.60	1.48 - 1.72	9-10	8.40	3.24	3.09 - 3.39
6	5.37	2.07	1.92 - 2.22	Prioritised Ethnicity			
7	6.10	2.35	2.19 - 2.52	European	3.66	1.00	
8	7.78	3.00	2.80 - 3.21	Māori	8.07	2.21	2.14 - 2.27
9	8.42	3.24	3.04 - 3.46	Pacific	11.77	3.22	3.10 - 3.34
10	8.38	3.23	3.03 - 3.44	Asian	4.29	1.17	1.11 - 1.24
Gender				Urban / Rural			
Female	4.51	1.00		Urban	5.85	1.00	
Male	6.22	1.38	1.34 - 1.42	Rural	2.75	0.47	0.45 - 0.49

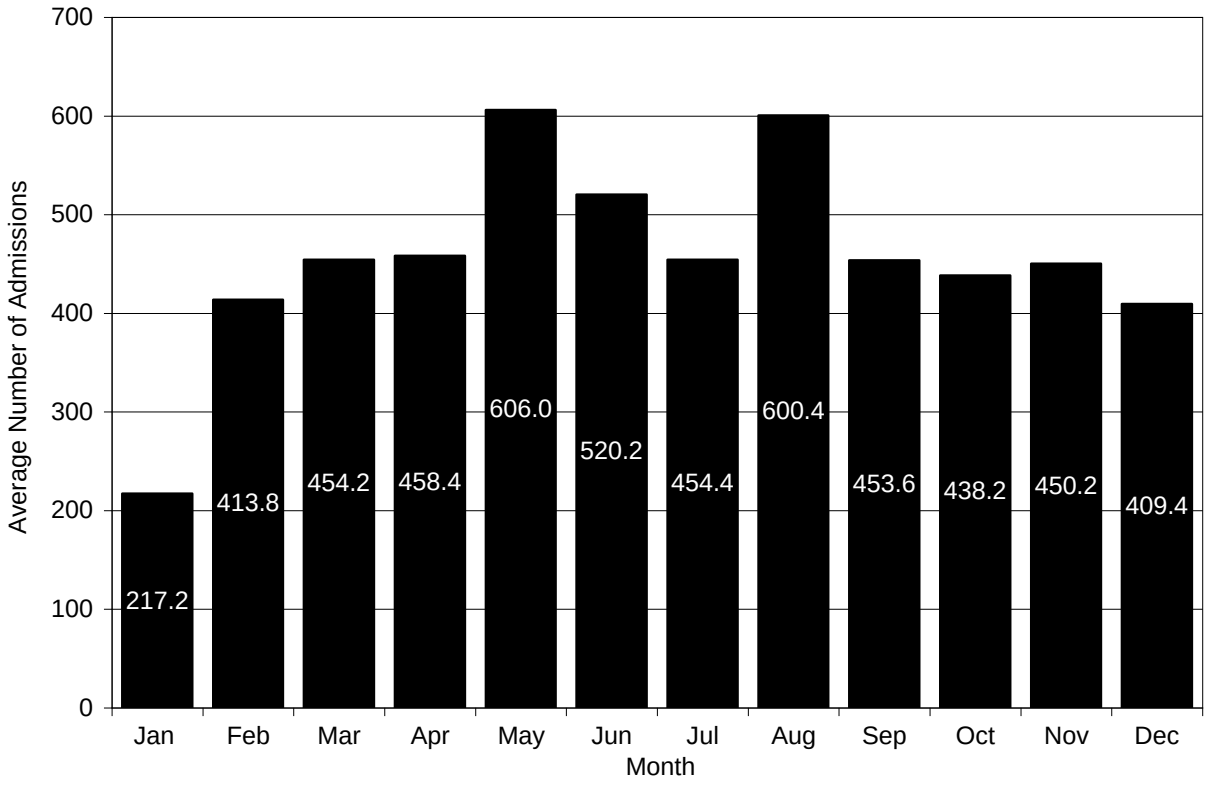
Source: Numerator-National Minimum Dataset; Denominator-Census; Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Figure 63 Hospital Admissions for Asthma in Children and Young People 0-24 Years by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 64. Average Number of Hospital Admissions due to Asthma per Month in Children and Young People 0-24 Years, New Zealand 2003-2007



Source: Numerator-National Minimum Dataset

Asthma Admissions Amongst Pacific Groups in New Zealand

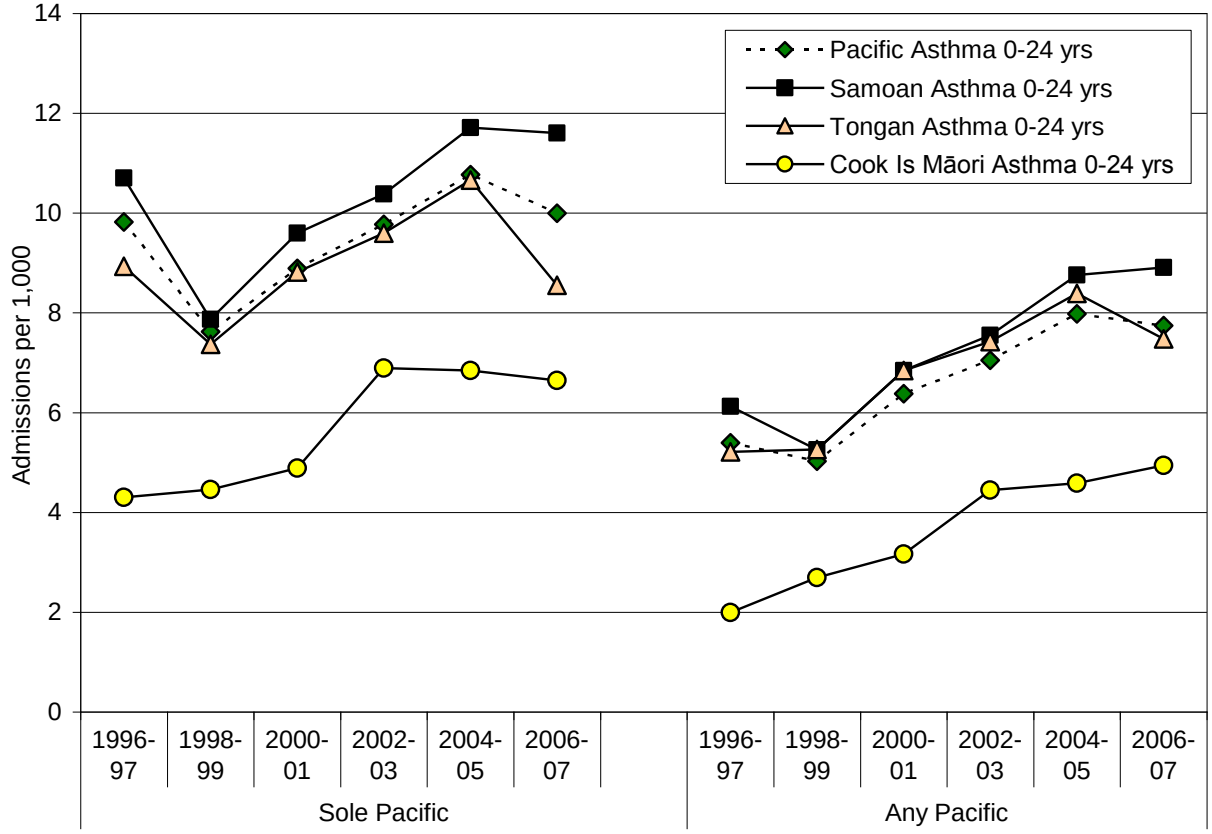
Pacific Group Trends

During 1996-2007 (using the Sole / Any classification), asthma admissions were consistently higher for Samoan and Tongan children and young people than for Cook Island Māori children and young people in both the Sole and Any Categories (**Figure 65**).

Distribution by Pacific Group

During 2003-2007 (using the Sole / Any classification), asthma admissions for Pacific children were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Groups. Within the Any and Sole categories, asthma admissions for Cook Island Māori children were *significantly lower* than for Samoan, Tongan, Niue and Fijian children. Rates for Sole Cook Island Māori children were also *significantly lower* than for Sole Tokelauan and Other Pacific children (**Table 52**).

Figure 65. Hospital Admissions for Asthma in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Table 52. Distribution of Hospital Admissions due to Asthma in Pacific Children 0-14 Years by Pacific Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	2,830	566.0	11.56	3.15	3.02-3.28
Any Tongan	1,027	205.4	10.01	2.73	2.56-2.90
Any Cook Island Māori	692	138.4	5.91	1.61	1.49-1.74
Any Niuean	393	78.6	8.96	2.44	2.21-2.70
Any Fijian	161	32.2	10.73	2.92	2.50-3.41
Any Tokelauan	99	19.8	7.02	1.91	1.57-2.33
Any Other Pacific	135	27.0	9.10	2.48	2.09-2.94
Any Pacific	5,048	1,009.6	10.27	2.80	2.71-2.89
Any Māori	8,037	1,607.4	8.07	2.20	2.14-2.26
Non-Māori Non-Pacific	10,831	2,166.2	3.67	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	2,099	419.8	16.71	4.55	4.34-4.77
Sole Tongan	775	155.0	12.88	3.51	3.26-3.77
Sole Cook Island Māori	386	77.2	9.19	2.50	2.26-2.77
Sole Niuean	201	40.2	22.71	6.19	5.39-7.10
Sole Fijian	74	14.8	15.79	4.30	3.43-5.40
Sole Tokelauan	53	10.6	14.33	3.90	2.99-5.10
Sole Other Pacific	85	17.0	13.62	3.71	3.00-4.59
Sole Pacific	3,701	740.2	14.73	4.01	3.87-4.16
Sole Māori	5,833	1,166.6	13.62	3.71	3.59-3.83
Non-Māori Non-Pacific	10,831	2,166.2	3.67	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted.

Summary

In New Zealand during 1990-2007, asthma admissions amongst young people declined. While admissions for children also declined during 1990-2003, an upswing in rates was evident during 2004-2007. Despite this, mortality during 1994-2005 remained relatively static. During 2003-2007, asthma admissions were highest for children <5 years, while mortality during 2001-2005 was highest for those in their late teens and early twenties. Asthma admissions were also *significantly higher* for Pacific > Māori > Asian > European children, males and those living in urban or deprived areas.

During 2003-2007 (using the Sole / Any classification), asthma admissions for Pacific children were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Groups. Within the Any and Sole categories, asthma admissions for Cook Island Māori children were *significantly lower* than for Samoan, Tongan, Niue and Fijian children. Rates for Sole Cook Island Māori children were also *significantly lower* than for Sole Tokelauan and Other Pacific children.

Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Asthma

In New Zealand there are no policy documents which focus solely on the prevention of asthma in children and young people. A range of documents however consider approaches to respiratory / infectious diseases and their risk factors more generally, and these have been reviewed in other sections of this report:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 31 on Page 119
2. **Interventions Aimed at Smoking** / **Tobacco Control:** Table 32 on Page 120.
3. **Interventions Aimed at Housing and Household Crowding:** Table 33 on Page 121
4. **Strategies to Improve Access to Primary Care:** Table 28 on Page 108

In addition, a range of evidence based review documents consider population and individual level approaches to the prevention of asthma and these are summarised briefly in **Table 53**.

Table 53. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Asthma

Ministry of Health Policy Documents
In New Zealand there are no policy documents which focus solely on the prevention of asthma, although population approaches to asthma are discussed on pages 86-93 of the Child and Youth Health Toolkit http://www.MOH.govt.nz/MOH.nsf/pagesmh/5411/$File/childandyouthhealthtoolkit.pdf[167]. In addition, a range of documents consider approaches to respiratory diseases and their risk factors more generally, and these have been reviewed in other sections of this report (see links above).
Systematic and Other Reviews from the International Literature
Gøtzsche PC, Johansen HK. **House Dust Mite Control Measures for Asthma**. Cochrane Database of Systematic Reviews 2008, Issue 2. This review assessed the effects of reducing exposure to house dust mite antigens in the homes of people with mite-sensitive asthma. It concluded that chemical and physical methods aimed at reducing exposure to house dust mite allergens could not be recommended. The authors felt it was doubtful whether further studies, similar to the ones included in this review, were worthwhile and recommended that if future studies are considered, they should be methodologically rigorous and use other methods than those used so far, with careful monitoring of mite exposure and relevant clinical outcomes.
Chang A, Taylor B, Masters I, et al. **Indigenous Healthcare Worker Involvement for Indigenous Adults and Children with Asthma.** Cochrane Database of Systematic Reviews 2007, Issue 4. This review considered whether involvement of an indigenous healthcare worker (IHW) (when compared to absence of an IHW) in asthma education programmes improved asthma related outcomes in indigenous children and adults with asthma. There was only one relevant study of 24 children, and the involvement of an IHW, specifically targeting clients of the same ethnic group, was beneficial in one, but not all, asthma-related outcomes. The authors concluded there was insufficient data to be absolutely confident that the involvement of IHW was beneficial in all like settings. Nevertheless, given the complexity of health outcomes and culture, as well as the importance of self-determination for indigenous peoples, the authors recommend the practice of including IHW in asthma education programmes for indigenous children and adults unless new research showed otherwise. The authors also recommended that further studies to inform relevant clinical practice and health policy in this area.
Bhogal S, Zemek R, Ducharme FM. **Written Action Plans for Asthma in Children**. Cochrane Database of Systematic Reviews 2006, Issue 3. This review evaluated the effects of providing, versus not providing, a written action plan in children and adolescents with asthma, and also compared the effect of different written action plans. The authors did not find any trials examining the benefit of providing, versus not providing, a written action plan to children with asthma. Four clinical trials with 355 children were identified which compared the effects of symptom-based, versus peak flow written action plans, when all other co-interventions were similar. Children assigned to a symptom-based plan less frequently required an acute care visit for asthma compared to those who received a peak flow based plan. Most other outcomes were similar with the exception of more children intending to continue using the symptom-based compared to the peak-flow based written action plan.

Paediatric Society of New Zealand. **Best Practice Evidence Based Guideline.** Management of Asthma in Children Aged 1-15 Years. 2005. Wellington. http://www.paediatrics.org.nz

This New Zealand guideline provides guidance for the appropriate clinical management of asthma in children aged 1-15 years.

Sheikh A, Alves B, Dhami S. **Pneumococcal Vaccine for Asthma**. Cochrane Database of Systematic Reviews 2002, Issue 1

Infection with Streptococcus pneumoniae is an important cause of pneumonia and other serious illnesses, particularly amongst those with certain high-risk medical conditions such as asthma. Although pneumococcal vaccine is routinely advocated for people with asthma, there is uncertainty about the evidence base that underpins this recommendation. A thorough search for randomised controlled trials of pneumococcal vaccine in asthma by the authors only found one small study in children which was not of high quality. This showed a reduction in the rate of asthma attacks from ten per year to seven per year. The reviewers concluded that randomised trials to test pneumococcal vaccine in asthmatic children and adults were needed to assess how beneficial it is for asthmatics to receive this vaccination.

Wolf F, Guevara J, Grum C, et al. **Educational Interventions for Asthma in Children.** Cochrane Database of Systematic Reviews 2002, Issue 4.

This review considered the efficacy of asthma self-management education on health outcomes in children. The authors concluded that learning self-management strategies related to asthma prevention or attack management can help improve children's lung function and feelings of self-control, as well as reduce school absences and days of restricted activity and decrease emergency room utilisation. There were no differences in the risk or frequency of hospitalisations between usual care and care supplemented with self-management education. These types of more rare and serious events may be beyond the ability of education to influence.

Other Relevant Publications

The Asthma and Respiratory Foundation of New Zealand. **Trying to Catch Our Breath: The Burden of Preventable Breathing Diseases in Children and Young People**, 2006. I. Asher and C. Byrnes, Editors. 2006: Wellington.

This review of the burden of respiratory disease in New Zealand children, specifically discusses asthma on pg 60-65. The review makes a number of recommendations to improve child asthma including reducing financial barriers to accessing health care and pharmaceuticals, improving asthma education, addressing poor housing, continuing to address clean air policies to reduce air pollution, developing appropriate strategies to reduce the burden of asthma for Māori and Pacific children, implementing evidence based guidelines on asthma management and developing strategies to address service delivery and health care provision to remote populations.

Å Bacterial / Viral Pneumonia

Introduction

The term pneumonia refers to a group of acute lower respiratory tract infections which lead to inflammation of the lung tissue. They are usually caused by inhaled micro-organisms from the upper respiratory tract, with the causative agent varying with the age of the child. In neonates, organisms from the mother's birth canal are the most common cause, while in infants > 4 months and preschool children viruses are a frequent cause, with the respiratory syncitial virus (RSV) being of particular importance. The most common bacterial cause after the neonatal period is *S. pneumoniae*, although *Chlamydia pneumoniae* and *Mycoplasma pneumoniae* have also been implicated, particularly in older children and adolescents [208]. Clinical manifestations include chills, fever, rapid pulse, high respiratory rate, cough, purulent sputum, chest pain and abdominal distension [202].

By international standards, New Zealand's pneumonia admission rates are high. New Zealand's rates also vary significantly by ethnicity, with Pacific and Māori children having both higher hospital admission rates [209] and more severe disease once admitted, than European children [175]. While risk factors for pneumonia overseas have included low socioeconomic status, poor nutrition, low birth weight, lack of breastfeeding, crowding and indoor smoke, it has been suggested that factors such as poor housing (cold, damp, mould, overcrowding), access to primary healthcare and poor nutrition (e.g. iron deficiency) are of particular importance in the New Zealand context [209].

The following section explores bacterial / viral pneumonia rates for Pacific children and young people living in New Zealand using information from the National Minimum Dataset and Mortality Collection. The section concludes with a review of policy and evidence based review documents which consider interventions to address pneumonia at the population level.

Data Source and Methods

Definition

Hospital Admissions and Deaths due to Bacterial / Viral Pneumonia in Children and Young People Aged 0-24 years

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions of children and young people (0-24 years) with a primary diagnosis of Pneumonia (ICD-9 480-486, 487.0; ICD-10 J12-J18, J10.0 J11.0)
Deaths Numerator: National Mortality Collection: Deaths in children and young people (0-24 years) where the main underlying cause of death (clinical code) was Pneumonia (ICD-9 480-486, 487.0; ICD-10 J12-J18, J10.0 J11.0)
Denominator: NZ Census

Notes on Interpretation

Note 1: The pneumonia coding used in this section differs from that used in the ASH section in that both bacterial and viral pneumonias have been included (in the ASH section, only bacterial pneumonias are considered to be ambulatory sensitive). In addition, *Appendix 4: The National Minimum Dataset* outlines the limitations of the hospital admission data used.
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category

Admissions: Proxy B-C; Mortality: Ideal B

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1992-2007, hospital admissions for pneumonia remained relatively static in both children and young people. Similarly mortality changed little during 1990-2005 (**Figure 66**).

New Zealand Distribution by Age

In New Zealand during 2003-2007, pneumonia admissions were highest for children aged one year and tapered off rapidly thereafter. In contrast, mortality during 2001-2005 was highest for infants <1 year of age (**Figure 67**).

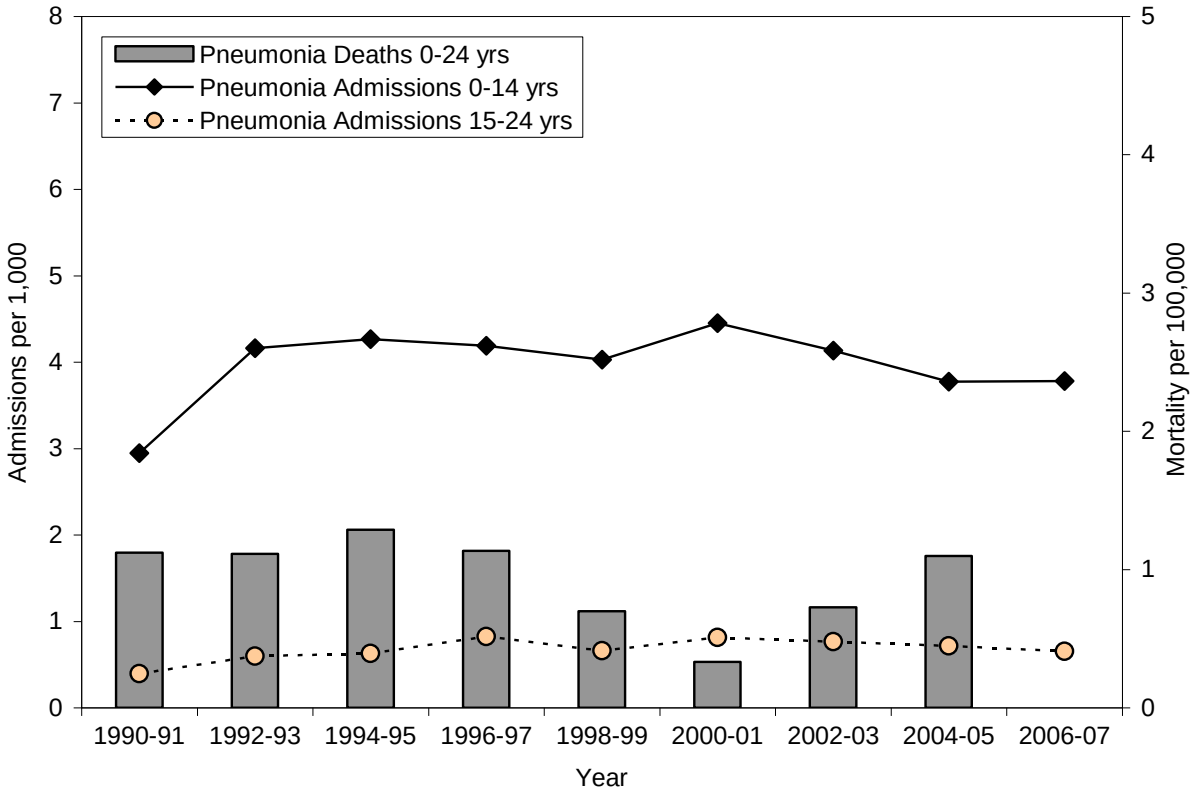
Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

In New Zealand during 2003-2007, pneumonia admissions were *significantly higher* for Pacific > Māori > Asian > European children, males and those living in urban or deprived areas (**Table 54**). Similarly, during 1996-2007 pneumonia admissions were higher for Pacific > Māori > European and Asian children and young people, with rates for Sole Pacific children and young people being higher than for Any Pacific children and young people throughout this period (**Figure 68**).

Distribution by Season

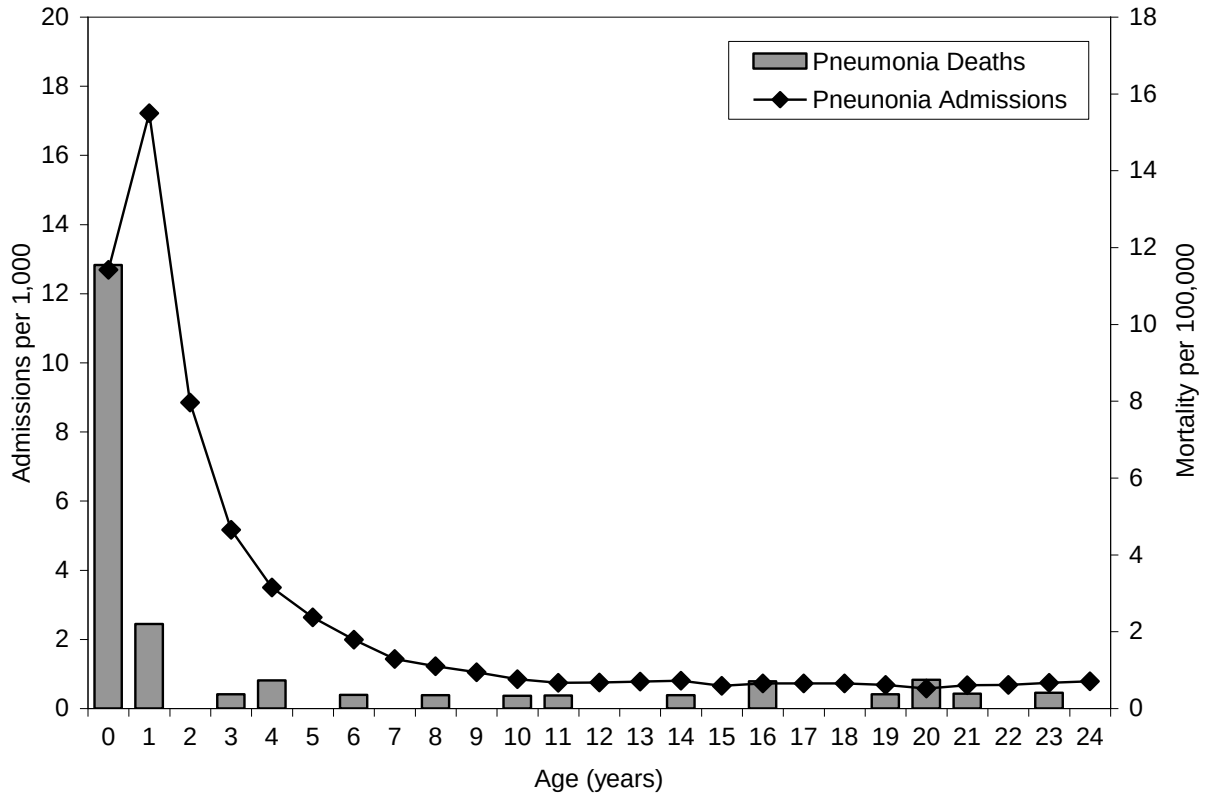
In New Zealand during 2003-2007, hospital admissions for pneumonia in children and young people were highest during winter and early spring (**Figure 69**).

Figure 66. Hospital Admissions (1990-2007) and Deaths (1990-2005) due to Bacterial / Viral Pneumonia in New Zealand Children and Young People 0-24 Years



Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census. Note: Mortality data unavailable for 2006-07.

Figure 67. Hospital Admissions (2003-2007) and Deaths (2001-2005) due to Bacterial / Viral Pneumonia in New Zealand Children and Young People 0-24 Years by Age



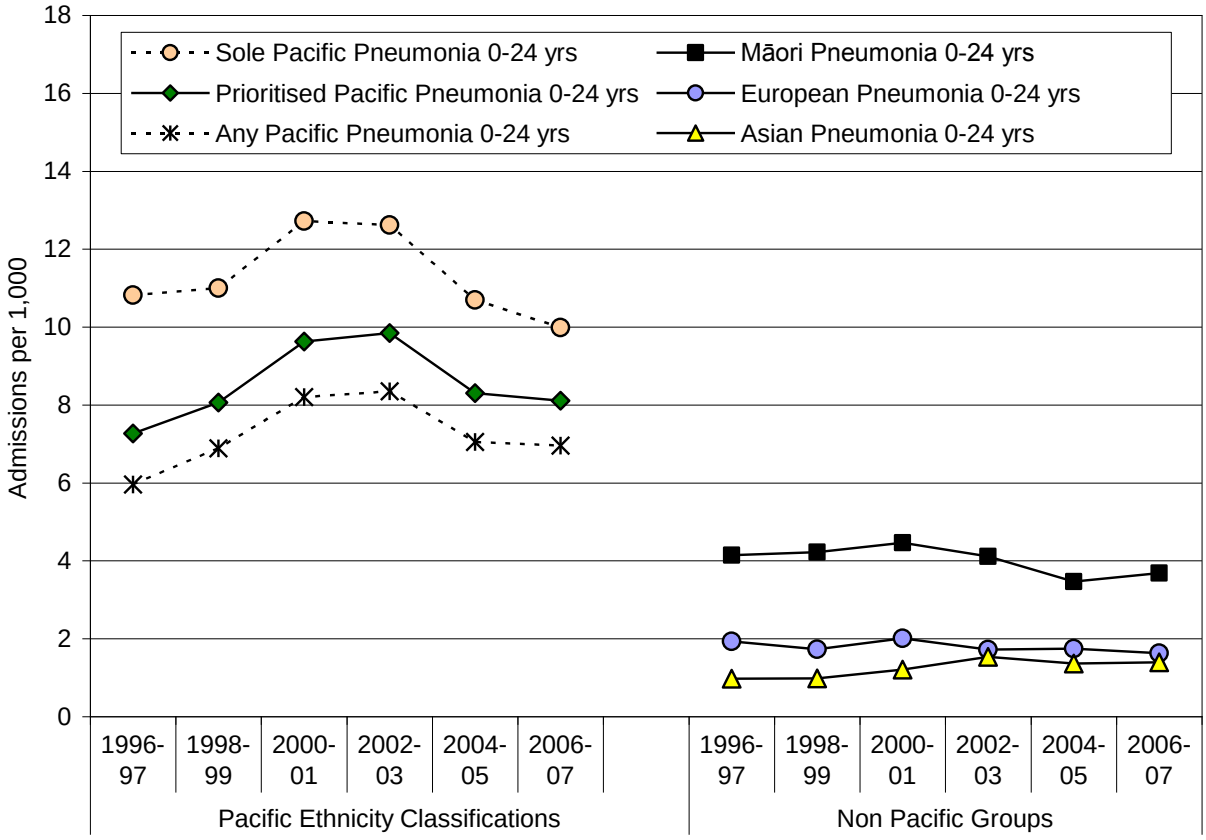
Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census

Table 54. Risk Factors for Hospital Admissions due to Bacterial / Viral Pneumonia in Children 0-14 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	1.83	1.00		1-2	1.83	1.00	
2	1.82	1.00	0.90 - 1.10	3-4	2.35	1.29	1.20 - 1.38
3	2.13	1.17	1.06 - 1.28	5-6	3.03	1.66	1.56 - 1.77
4	2.57	1.40	1.28 - 1.54	7-8	4.27	2.34	2.21 - 2.49
5	2.66	1.45	1.33 - 1.59	9-10	6.93	3.80	3.59 - 4.01
6	3.41	1.86	1.71 - 2.03	Prioritised Ethnicity			
7	3.43	1.88	1.72 - 2.05	European	2.42	1.00	
8	5.08	2.78	2.56 - 3.01	Māori	4.95	2.04	1.97 - 2.12
9	5.98	3.27	3.02 - 3.54	Pacific	12.26	5.06	4.87 - 5.26
10	7.71	4.21	3.91 - 4.54	Asian	2.63	1.09	1.01 - 1.17
Gender				Urban / Rural			
Female	3.63	1.00		Urban	4.18	1.00	
Male	4.05	1.12	1.08 - 1.15	Rural	1.90	0.46	0.43 - 0.48

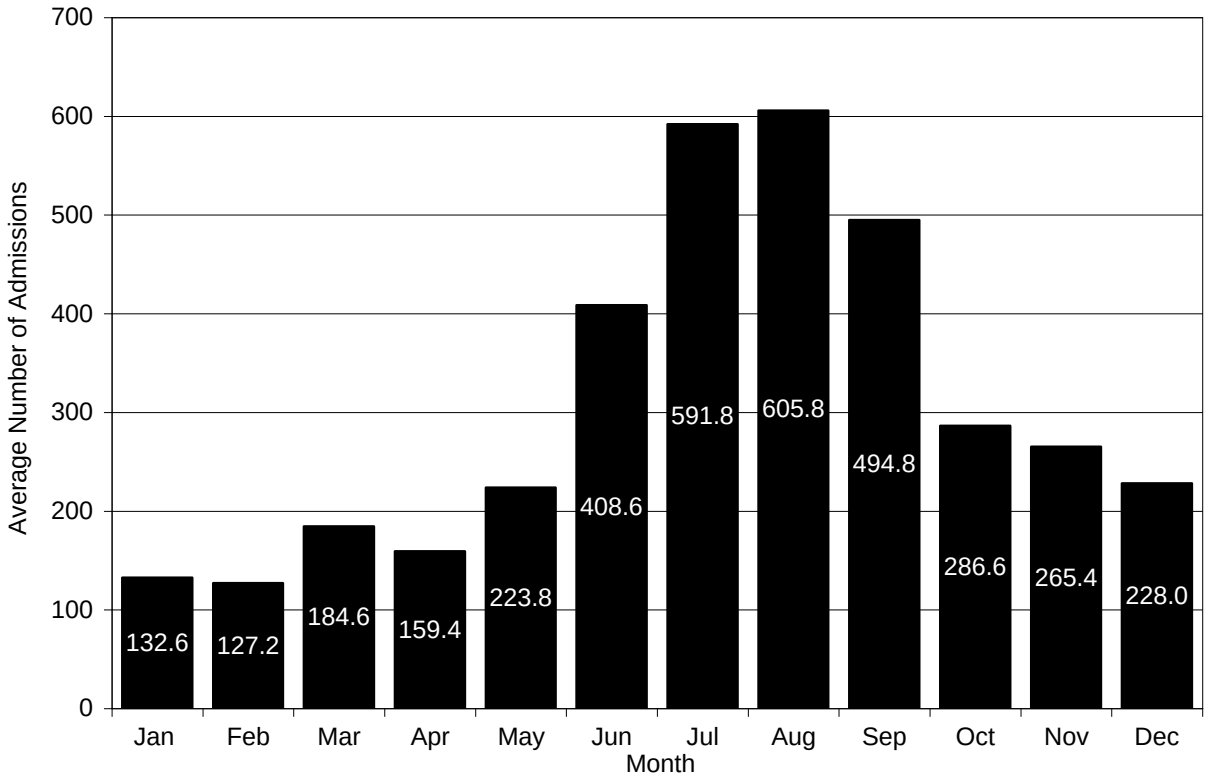
Source: Numerator-National Minimum Dataset; Denominator-Census Note: Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Figure 68. Hospital Admissions for Bacterial / Viral Pneumonia in Children and Young People 0-24 Years by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 69. Average Number of Hospital Admissions due to Bacterial / Viral Pneumonia per Month in Children and Young People 0-24 Years, New Zealand 2003-2007



Source: Numerator-National Minimum Dataset.

Pneumonia Admissions Amongst Pacific Groups in New Zealand

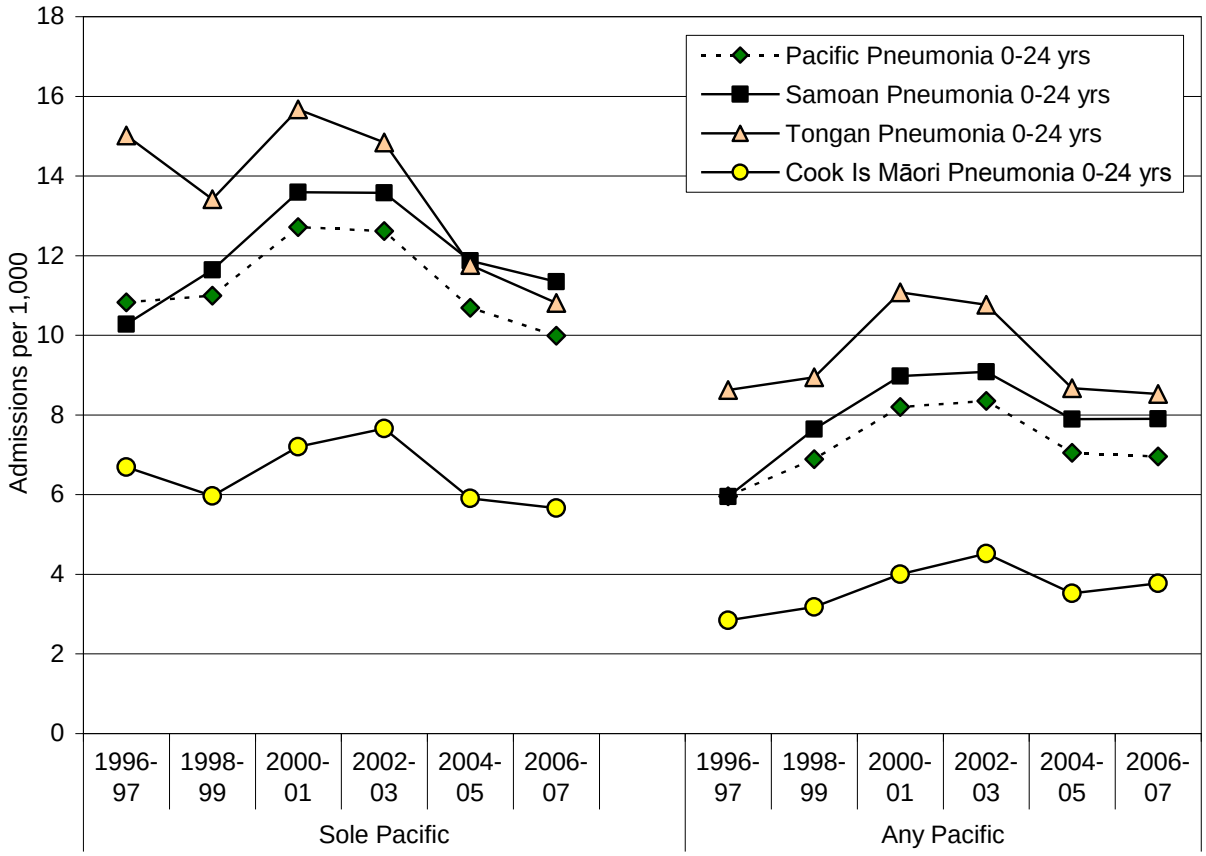
Pacific Group Trends

During 1996-2007, pneumonia admissions were consistently lower for Cook Island Māori children and young people than for Samoan and Tongan children and young people in both the Any and Sole Categories (**Figure 70**).

Distribution by Pacific Group

During 2003-2007 (using the Sole / Any classification), pneumonia admissions for Pacific children were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Groups. Within the Any Category, pneumonia admissions for Tongan and Samoan children were *significantly higher* than for Cook Island Māori, Niue, Fijian and Tokelauan children. Within the Sole Category, pneumonia admissions for Cook Island Māori children were *significantly lower* than for Tongan, Samoan or Niue children (**Table 55**).

Figure 70. Hospital Admissions for Bacterial / Viral Pneumonia in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any/Sole Classification (see page 333 for details).

Table 55. Distribution of Hospital Admissions for Bacterial / Viral Pneumonia in Pacific Children 0-14 Years by Pacific Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	2,800	560.0	11.44	4.74	4.54-4.95
Any Tongan	1,221	244.2	11.90	4.93	4.64-5.24
Any Cook Island Māori	580	116.0	4.95	2.05	1.89-2.23
Any Niuean	269	53.8	6.13	2.54	2.25-2.87
Any Fijian	90	18.0	6.00	2.48	2.02-3.06
Any Tokelauan	105	21.0	7.45	3.09	2.55-3.74
Any Other Pacific	146	29.2	9.85	4.08	3.47-4.80
Any Pacific	4,943	988.6	10.06	4.17	4.02-4.32
Any Māori	4,927	985.4	4.95	2.05	1.98-2.13
Non-Māori Non-Pacific	7,119	1,423.8	2.41	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	2,277	455.4	18.12	7.51	7.17-7.87
Sole Tongan	989	197.8	16.44	6.81	6.38-7.28
Sole Cook Island Māori	359	71.8	8.55	3.54	3.19-3.94
Sole Niuean	129	25.8	14.58	6.04	5.08-7.18
Sole Fijian	48	9.6	10.24	4.24	3.20-5.63
Sole Tokelauan	49	9.8	13.25	5.49	4.15-7.26
Sole Other Pacific	111	22.2	17.79	7.37	6.12-8.88
Sole Pacific	4,000	800.0	15.92	6.60	6.35-6.86
Sole Māori	3,856	771.2	9.01	3.73	3.59-3.88
Non-Māori Non-Pacific	7,119	1,423.8	2.41	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted.

Summary

In New Zealand during 1992-2007, hospital admissions for bacterial / viral pneumonia remained relatively static in both children and young people. Similarly mortality changed little during 1990-2005. During 2003-2007, pneumonia admissions were highest for children <3 years of age and tapered off rapidly thereafter. A similar pattern was seen for mortality during 2001-2005, with the highest rates being seen in infants <1 year. Pneumonia admissions were also *significantly higher* for Pacific > Māori > Asian > European children, males and those in urban or deprived areas.

During 2003-2007 (using the Sole / Any classification), pneumonia admissions for Pacific children were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Groups. Within the Any Category, pneumonia admissions for Tongan and Samoan children were *significantly higher* than for Cook Island Māori, Niue, Fijian and Tokelauan children. Within the Sole Category, pneumonia admissions for Cook Island Māori children were *significantly lower* than for Tongan, Samoan or Niue children.

Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Pneumonia

In New Zealand there are no policy documents which focus solely on the prevention of pneumonia in children and young people. A range of documents however consider approaches to respiratory / infectious diseases and their risk factors more generally, and these have been reviewed in other sections of this report:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 31 on Page 119
2. **Interventions Aimed at Smoking** / **Tobacco Control:** Table 32 on Page 120.
3. **Interventions Aimed at Housing and Household Crowding:** Table 33 on Page 121
4. **Interventions Aimed at Breastfeeding:** Breastfeeding Section on Page 58

In addition, a small number of publications were specific to the prevention of lower respiratory tract infections, and these are briefly reviewed in **Table 56**.

Table 56. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Pneumonia

Ministry of Health Policy Documents
In New Zealand there are no policy documents which focus solely on the prevention of pneumonia, although a range of documents consider the prevention of infectious and respiratory diseases more generally (see links on previous page)
Systematic and Other Reviews from the International Literature
Jefferson T, Rivetti A, Harnden A, et al. **Vaccines for Preventing Influenza in Healthy Children**. Cochrane Database of Systematic Reviews 2008, Issue 2. Influenza has a viral origin and often results in an acute respiratory illness affecting the upper and / or lower respiratory tract. Recent policy from several internationally-recognised institutions, recommend immunising healthy children 6-23 months of age (together with their contacts) as a public health measure. This review found that in children aged from two years, nasal spray vaccines made from weakened influenza viruses were better at preventing illness caused by the influenza virus (82% of illnesses prevented) than injected vaccines made from killed virus (59%). In children <2 years, the efficacy of inactivated vaccine was similar to placebo. It was not possible to analyse the safety of vaccines from the studies due to the lack of standardisation in the information provided, but very little information was found on the safety of inactivated vaccines, the most commonly used vaccine in young children.
Other Relevant Publications
The Asthma and Respiratory Foundation of New Zealand. **Trying to Catch Our Breath: The Burden of Preventable Breathing Diseases in Children and Young People**, 2006. I. Asher and C. Byrnes, Editors. 2006: Wellington. In this review of the burden of respiratory infections in New Zealand children, pneumonia is specifically discussed on pages 35-39. Recommendations for decreasing rates of pneumonia include improved access to higher quality primary care for all children, more effective early childhood policies relating to immunisation and nutrition and a fundamental improvement in the indoor environment.
Health Care Needs Assessment. **Lower Respiratory Disease**. 1994, Health Care Needs Assessment. This chapter reviews lower respiratory disease. It specifically looks at lower respiratory infections in children. Primary prevention strategies for lower respiratory tract infections are identified including reducing passive exposure to tobacco smoke, promoting breastfeeding and vaccinating against whooping cough and measles.

Å Bronchiectasis

Introduction

The term bronchiectasis originates from Greek, literally meaning ‘stretching of the windpipe’. Bronchiectasis is usually a progressive disease characterised by bronchial dilatation, with or without associated damage to the bronchial wall and lung parenchyma, and is usually accompanied by pus in the bronchial lumen. Clinically, bronchiectasis results in a persistent wet cough, with purulent sputum production in the older child and recurrent respiratory exacerbations. The symptoms result in significant morbidity, with lost schooldays and multiple absences from work for parents of affected children. Children with extensive bronchiectasis also have a reduced exercise capacity, may have slower growth [210], with finger clubbing and persistent coarse crackles on examination. Continued problems with untreated / extensive disease may progress to respiratory failure and premature death [211].

The estimated prevalence for New Zealand children is 7 times higher than the only country (Finland) for which comparable incidence figures are available [212]. By their 15th birthday, 1:1700 New Zealand children will be diagnosed with bronchiectasis, with the incidence being 12 times higher for Pacific and 3 times higher for Māori children [212]. In addition, recent research suggests that lung involvement may be particularly widespread and severe in Pacific and Māori children [213]. Bronchiectasis also demonstrates a marked socioeconomic gradient, with 67% of children in one study living in NZDep deciles 8-10 (the most deprived 30% of areas) and 58% living in households where one or more family members smoked [214]. Yet despite recent advances in the diagnosis of bronchiectasis, its aetiology often remains unclear, with 50% of paediatric cases in one New Zealand study having an unknown aetiology (although 37% had a history of recurrent lower respiratory infection and a further 25% were presumed secondary to severe pneumonia [214]).

The following section explores bronchiectasis rates amongst Pacific children and young people in New Zealand children using information from the National Minimum Dataset and Mortality Collection. The section concludes with a review of policy and evidence based review documents which consider interventions to address bronchiectasis at the population level.

Data Source and Methods

Definition

Hospital Admissions and Mortality from Bronchiectasis (where Cystic Fibrosis is Not Listed as a Co-Morbidity) in Children and Young People 0-24 Years

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions of children and young people (0-24 years) with a diagnosis of Bronchiectasis (ICD-10 J47) in any of the first 10 diagnostic codes. Cases where cystic fibrosis (ICD-10 E84) was mentioned in the first 10 diagnostic codes were excluded.

Deaths Numerator: National Mortality Collection: Deaths in children and young people (0-24 years) where the main underlying cause of death (clinical code) was Bronchiectasis (ICD-9 494; ICD-10 J47) and where Cystic Fibrosis (ICD-10 E84) was not listed as a co-morbidity.

Denominator: NZ Census

Notes on Interpretation

Note 1: Because children and young people with cystic fibrosis may also develop bronchiectasis over time, and because the epidemiology of cystic fibrosis and non-cystic fibrosis bronchiectasis are likely to differ considerably, cases where cystic fibrosis was mentioned as a co-morbidity have been removed from this analysis. In addition, care must be taken when interpreting trends in bronchiectasis admissions over time, as it remains unclear whether they represent an increase in the underlying burden of disease, an increase in access to hospitalisation, or an increase in the use of High Resolution CT to diagnose bronchiectasis in this population. In addition, *Appendix 4: The National Minimum Dataset* outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category

Admissions: Proxy B-C; Mortality: Ideal B

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1990-2007, hospital admissions for bronchiectasis in children and young people increased rapidly, reached a peak in 2004-2005 and thereafter declined. Care must be taken when interpreting these trends however, as it remains unclear whether they represent an increase in the underlying burden of disease, an increase in access to hospitalisation, or an increase in the use of High Resolution CT to diagnose bronchiectasis in this population. Trends in mortality during 1990-2005 were more inconsistent (**Figure 71**).

Distribution by Age

In New Zealand during 2003-2007, bronchiectasis admissions were highest amongst those <17 years of age (**Figure 72**).

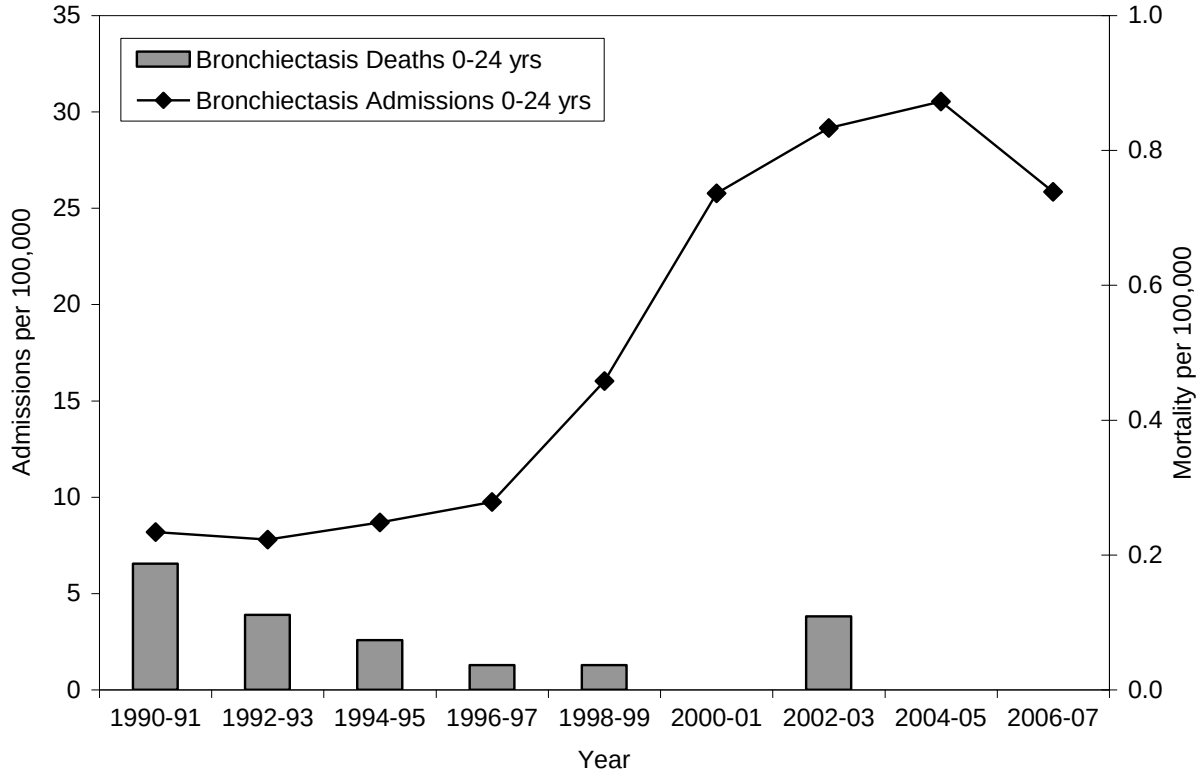
Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Distribution

In New Zealand during 2003-2007, bronchiectasis admissions were *significantly higher* for Pacific > Māori > European and Asian children and young people, and those living in urban or deprived areas (**Table 57**). Similar ethnic differences were seen throughout 1996-2007, with admissions being higher for Sole than for Any Pacific children and young people during this period (**Figure 73**).

Distribution by Season

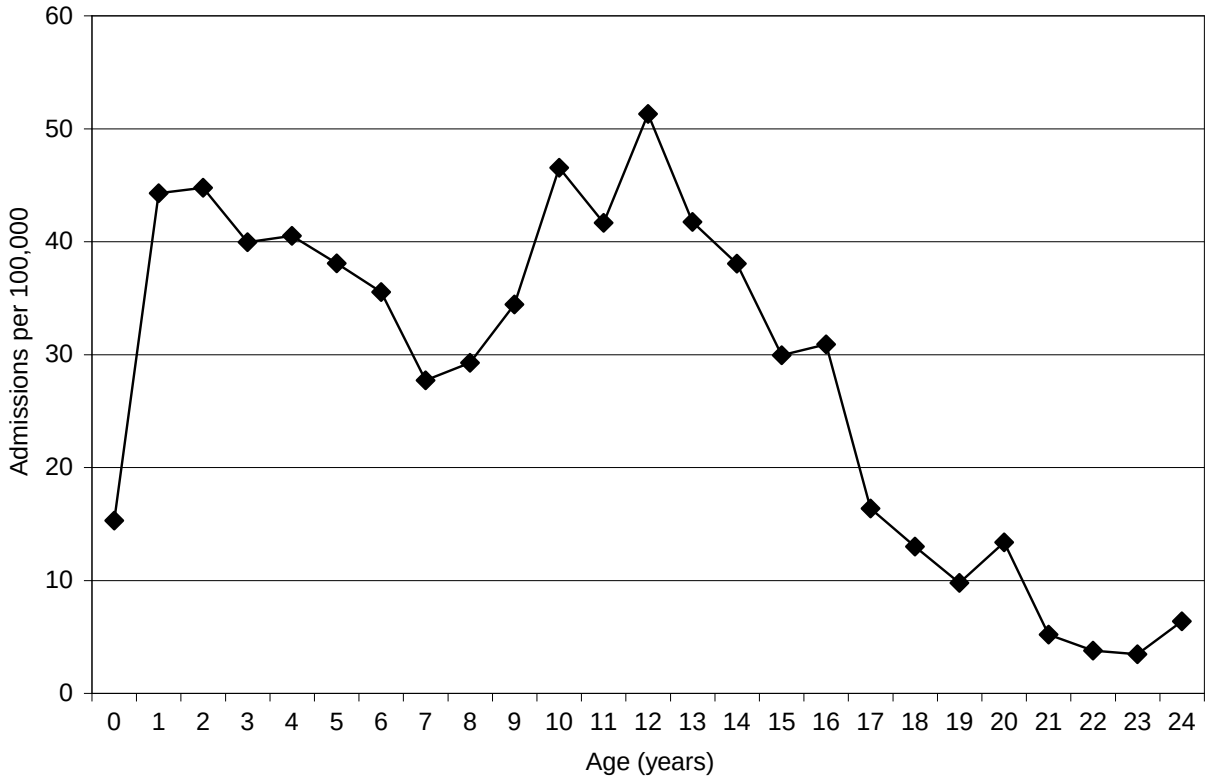
In New Zealand during 2003-2007, hospital admissions for bronchiectasis in children and young people were lowest during January and February (**Figure 74**).

Figure 71. Hospital Admissions (1990-2007) and Deaths (1990-2005) due to Bronchiectasis in New Zealand Children and Young People 0-24 Years



Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census. Note: Mortality data unavailable for 2006-07.

Figure 72. Hospital Admissions for Bronchiectasis in Children and Young People 0-24 Years by Age, New Zealand 2003-2007



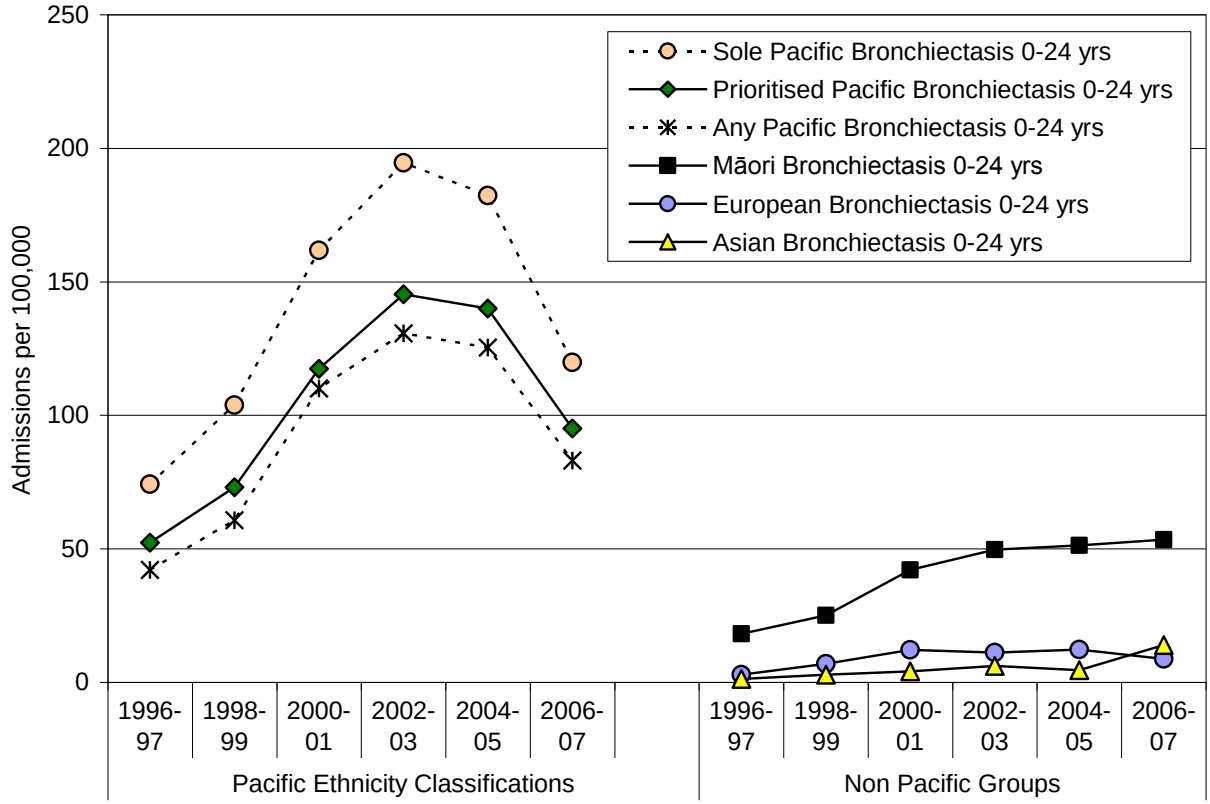
Source: Numerator-National Minimum Dataset; Denominator-Census

Table 57. Risk Factors for Hospital Admission due to Bronchiectasis in Children and Young People 0-24 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	5.45	1.00		1-2	6.32	1.00	
2	7.20	1.32	0.86 - 2.03	3-4	11.35	1.80	1.38 - 2.34
3	15.16	2.78	1.91 - 4.06	5-6	22.12	3.50	2.75 - 4.46
4	7.48	1.37	0.90 - 2.10	7-8	29.72	4.71	3.73 - 5.94
5	19.35	3.55	2.46 - 5.12	9-10	62.73	9.93	7.96 - 12.38
6	24.81	4.55	3.19 - 6.50	Prioritised Ethnicity			
7	19.79	3.63	2.52 - 5.22	European	10.94	1.00	
8	39.17	7.19	5.10 - 10.13	Māori	52.04	4.76	4.23 - 5.35
9	50.59	9.28	6.63 - 13.00	Pacific	121.41	11.09	9.84 - 12.50
10	73.67	13.52	9.71 - 18.83	Asian	8.94	0.82	0.62 - 1.07
Gender				Urban / Rural			
Female	28.08	1.00		Urban	31.84	1.00	
Male	28.91	1.03	0.94 - 1.12	Rural	6.77	0.21	0.17 - 0.27

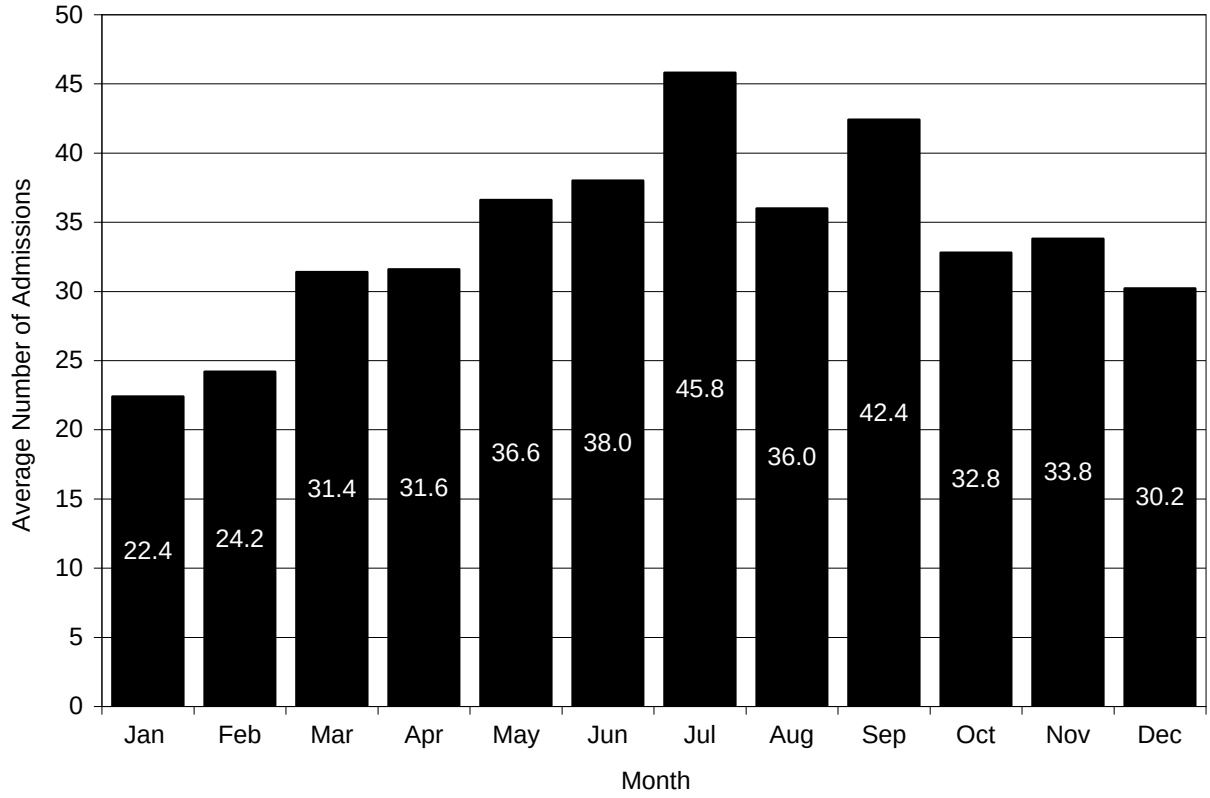
Source: Numerator-National Minimum Dataset; Denominator-Census; Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted

Figure 73. Hospital Admissions for Bronchiectasis in Children and Young People 0-24 Years by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 74. Average Number of Admissions for Bronchiectasis per Month for Children and Young People 0-24 Years, New Zealand 2003-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised

Bronchiectasis Admissions Amongst Pacific Groups in New Zealand

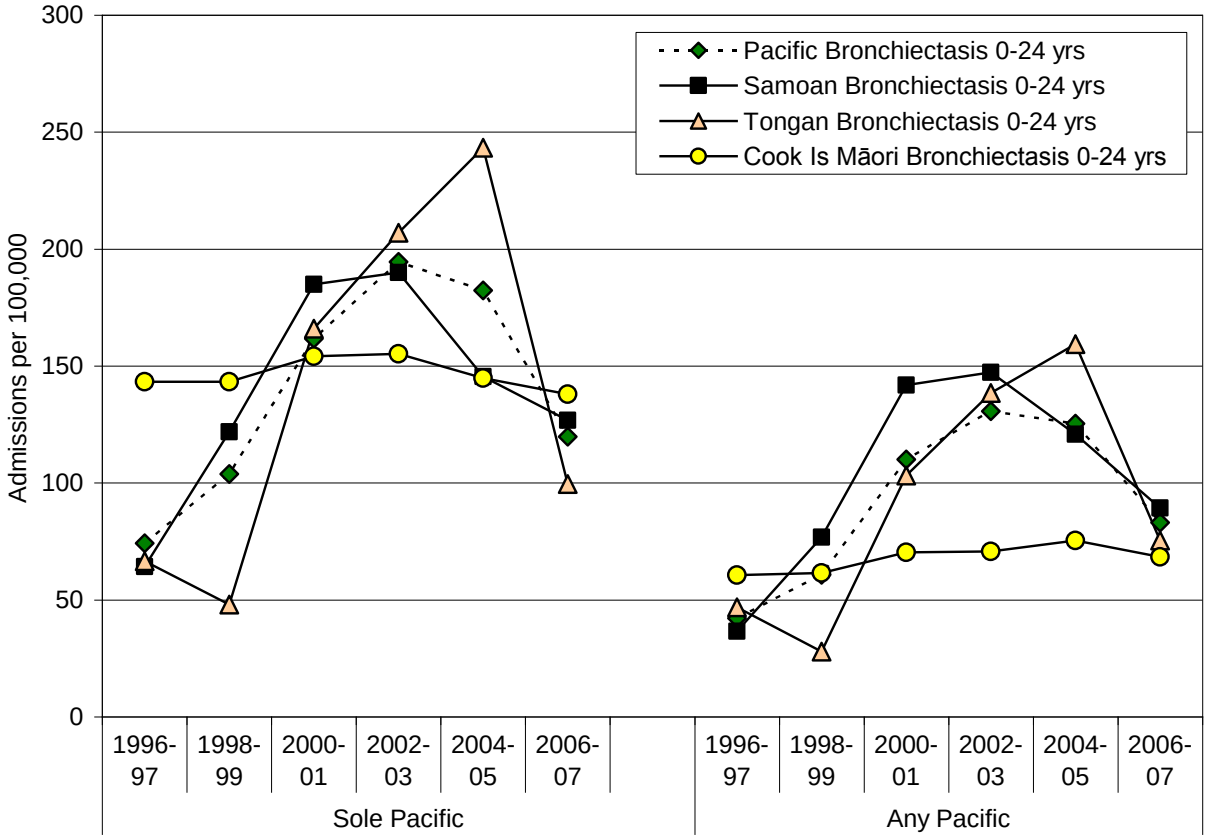
Pacific Group Trends

During 1996-2007 (using the Sole / Any classification), there were no consistent differences in bronchiectasis admissions between Samoan, Tongan and Cook Island Māori children and young people in either the Sole or Any categories (**Figure 75**).

Distribution by Pacific Group

During 2003-2007 (using the Sole / Any classification), bronchiectasis admissions for Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of Fijian children and young people). Within the Any Category, bronchiectasis admissions for Niue, Tongan and Samoan children and young people were *significantly higher* than for Cook Island Māori and Fijian children and young people. Within the Sole Category, bronchiectasis admissions for Niue children and young people were *significantly higher* than for the other Pacific groups (**Table 58**).

Figure 75. Hospital Admissions for Bronchiectasis in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Table 58. Distribution of Hospital Admissions due to Bronchiectasis in Pacific Children 0-24 Years by Pacific Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Any Samoan	391	78.2	108.59	9.84	8.64-11.19
Any Tongan	169	33.8	117.31	10.63	8.95-12.62
Any Cook Island Māori	130	26.0	76.14	6.90	5.70-8.35
Any Niuean	87	17.4	134.06	12.14	9.69-15.22
Any Fijian	5	1.0	20.91	1.89	0.79-4.57
Any Tokelauan	18	3.6	88.63	8.03	5.02-12.83
Any Other Pacific	13	2.6	58.49	5.30	3.06-9.18
Any Pacific	783	156.6	107.79	9.76	8.76-10.88
Any Māori	777	155.4	52.04	4.71	4.23-5.26
Non-Māori Non-Pacific	557	111.4	11.04	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Sole Samoan	280	56.0	140.69	12.74	11.04-14.71
Sole Tongan	152	30.4	172.77	15.65	13.08-18.72
Sole Cook Island Māori	107	21.4	155.03	14.04	11.42-17.27
Sole Niuean	66	13.2	410.22	37.15	28.80-47.93
Sole Fijian	<5	s	s	s	s
Sole Tokelauan	5	1.0	78.73	7.13	2.96-17.19
Sole Other Pacific	13	2.6	131.59	11.92	6.88-20.65
Sole Pacific	628	125.6	158.23	14.33	12.79-16.06
Sole Māori	615	123.0	90.95	8.24	7.35-9.24
Non-Māori Non-Pacific	557	111.4	11.04	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted.

Summary

In New Zealand during 1990-2007, bronchiectasis admissions in children and young people increased rapidly, reached a peak in 2004-2005 and thereafter declined. Care must be taken when interpreting these trends however, as it remains unclear whether they represent an increase in the underlying burden of disease, an increase in access to hospitalisation, or an increase in the use of High Resolution CT to diagnose bronchiectasis in this population. Mortality trends during 1990-2005 however, were more inconsistent. During 2003-2007, bronchiectasis admissions were highest for those <17 years of age. Admissions were also *significantly higher* for Pacific > Māori > European and Asian children and young people, and those living in urban or deprived areas.

During 2003-2007 (using the Sole / Any classification), bronchiectasis admissions for Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of Fijian children and young people). Within the Any Category, bronchiectasis admissions for Niue, Tongan and Samoan children and young people were *significantly higher* than for Cook Island Māori and Fijian children and young people. Within the Sole Category, bronchiectasis admissions for Niue children and young people were *significantly higher* than for the other Pacific groups.

Local Policy Documents and Evidence Based Reviews Relevant to the Prevention & Management of Bronchiectasis

In New Zealand there are no policy documents which focus solely on the prevention of bronchiectasis in children and young people. A range of documents, however, consider approaches to respiratory / infectious diseases and their risk factors more generally, and these have been reviewed in other sections of this report:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 31 on Page 119
2. **Interventions Aimed at Smoking** / **Tobacco Control:** Table 32 on Page 120.
3. **Interventions Aimed at Housing and Household Crowding:** Table 33 on Page 121
4. **Interventions Aimed at Breastfeeding:** Breastfeeding Section on Page 58

In addition, a number of publications consider the most effective approaches to the prevention and management of bronchiectasis and these are considered briefly in **Table 59**.

Table 59. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention and Management of Bronchiectasis

Ministry of Health Policy Documents
In New Zealand there are no policy documents which focus solely on the prevention of Bronchiectasis, although a range of documents consider the prevention of infectious and respiratory diseases more generally (see links above)
Systematic and Other Reviews from the International Literature
Chang C, Singleton R, Morris P et al. **Pneumococcal Vaccines for Children and Adults with Bronchiectasis**. Cochrane Database of Systematic Reviews 2007, Issue 2. This review evaluated the effectiveness of pneumococcal vaccine as routine management in children and adults with bronchiectasis in (a) reducing the severity and frequency of respiratory exacerbations and (b) pulmonary decline. The authors found that there is a lack of reliable evidence to support or refute the use of pneumococcal vaccine as routine management in children and adults with bronchiectasis. Randomised controlled trials examining the efficacy of this intervention using various vaccine types in different age groups are needed. Until further evidence is available, it is recommended that health providers adhere to national guidelines.
Chang C, Morris P, Chang A. **Influenza Vaccine for Children and Adults with Bronchiectasis.** Cochrane Database of Systematic Reviews 2007, Issue 3. This review evaluated the effectiveness of influenza vaccine as routine management in children and adults with bronchiectasis in (a) reducing the severity and frequency of respiratory exacerbations and (b) pulmonary decline. In this review no randomised control trials examining the effectiveness of influenza vaccines for people with bronchiectasis were found. The authors recommend that in the absence of evidence, patients' needs should be individualised and national guidelines be adhered to.
French J, Bilton D, Campbell F. **Nurse Specialist Care for Bronchiectasis**. Cochrane Database of Systematic Reviews 2003, Issue 3. This review evaluated the effectiveness of nurse-led care in the management of bronchiectasis. It found one trial that did not demonstrate significant differences in clinical outcomes between nurse-led care and doctor led care within the setting of a specialist clinic, but there may be increased cost implications. The authors recommend that further research be undertaken to review whether nurse led care provides the same outcomes in the community or secondary care setting.
Chang A, Grimwood K, Mulholland E, et al. Working Group on Indigenous Paediatric Respiratory Health. **Bronchiectasis in Indigenous Children in Remote Australian Communities**. Medical Journal of Australia, 2002. 177(4):200-4. This review recommended that the management of children with bronchiectasis should include regular review, encouragement of physical activity, optimising nutrition, maintenance of immunisation and avoidance of environmental toxicants, including passive smoke exposure. The review also noted that successful management of bronchiectasis required improvements in housing, nutrition, and education, as well as access to comprehensive healthcare services, with coordination between primary and hospital-based healthcare providers.

Other Relevant Publications
The Asthma and Respiratory Foundation of New Zealand. **Trying to Catch Our Breath: The Burden of Preventable Breathing Diseases in Children and Young People**, 2006. I. Asher and C. Byrnes, Editors. 2006: Wellington. This review of the burden of respiratory disease in New Zealand children specifically considers bronchiectasis on pages 51-55. It makes a number of recommendations for prevention and management including a reduction in overcrowding, improving socioeconomic resources in deprived areas, reducing smoking rates, improving vaccination coverage, early investigation of children with symptoms suggestive of bronchiectasis, and improved management options based on research.
Edwards E, Asher I, Byrnes C. **Paediatric Bronchiectasis in the Twenty-First Century: Experience of a Tertiary Children's Hospital in New Zealand**. Journal of Paediatrics & Child Health, 2003. 39(2):111-7. This study documented the number of children with bronchiectasis in Auckland, their clinical characteristics and possible aetiology, and then estimated a crude bronchiectasis prevalence rate for New Zealand. The study also considered the relationships between ethnicity, poverty and bronchiectasis, as well as the mechanisms via which low socioeconomic status contributed to the incidence of bronchiectasis (e.g. increased exposure to cigarette smoke, language difficulties impacting on families' ability to access health services, lower than average immunisation rates).

Infectious Diseases

Å Immunisation Coverage and Vaccine Preventable Diseases

Introduction

Immunisation is among the most successful and cost-effective public health interventions [215, 216]. There are many celebrated successes including the eradication of smallpox in 1977, a worldwide decrease in poliomyelitis by 99% since 1988, and the elimination of measles from many parts of the world [215, 217]. Immunisation not only protects individuals, but through the effect of 'herd immunity' benefits the whole community. A major benefit from immunisation is the potential to reduce socioeconomic disparities which are evident in vaccine preventable disease.

The following section reviews immunisation coverage rates and vaccine preventable diseases amongst Pacific children in New Zealand from three different perspectives:

1. Immunisation Coverage, using data from the National Immunisation Register
2. Hospital Admissions for Pertussis in Infants <1 Year
3. Notifications and Hospital Admissions for Vaccine Preventable Diseases

The section concludes with a brief review of New Zealand policy documents and international evidence based reviews which consider the best way to improve immunisation coverage rates at the population level.

Immunisation Coverage

The New Zealand Childhood Immunisation Schedule offers free immunisations which protect against ten vaccine preventable diseases; Diphtheria, Tetanus, Pertussis, Poliomyelitis, Hepatitis B, Haemophilus influenzae type b, Measles, Mumps, Rubella and Pneumococcal Disease (**Table 60**). In addition, the Schedule offers publicly funded immunisation to those at risk of influenza and tuberculosis.

When reviewing immunisation coverage for Pacific children at 2 years of age, the Pacific Island Families (PIF) Study (a longitudinal study of 1,376 Pacific infants born in 2000) noted that while immunisation coverage (89%) was lower than the Ministry of Health's Target of 95%, coverage was substantially higher than the 53% noted for Pacific children in a national immunisation survey a decade earlier [218]. In the same study, factors associated with non-immunisation by 6 weeks of age were the infant's mother being Pacific born, having more than 5 children, or having difficulty with transport, while factors associated with incomplete vaccination at 2 years of age were higher parity and maternal smoking [218].

Table 60. Immunisation Schedule for Children Aged 0-11 Years, New Zealand Sept 2008

Age	Immunisation given					
	DTaP-IPV-HepB/Hib	PCV7	Hib	MMR	dTap-IPV	dTap
6 weeks	•	•				
3 months	•	•				
5 months	•	•				
15 months		•*	•	•		
4 years				•	•	
11 years						•

Key: D: diphtheria, d: adult diphtheria; T: tetanus; aP: acellular Pertussis, ap: adult acellular Pertussis; Hib: *Haemophilus influenzae* type b; Hep B: hepatitis B, IPV: inactivated polio vaccine; MMR: measles, mumps, rubella; PCV7: Pneumococcal (Prevenar) funded for infants born from 01 January 2008. Source: Ministry of Health [219].

During the 1990s / early 2000s such studies provided the only information on immunisation coverage for Pacific children in New Zealand. Since the National Immunisation Register (NIR) began collecting routine immunisation information in 2005 however, coverage data has become more readily available, with coverage being measured at the 'milestone ages' of 6 months, 12 months, 18 months, 24 months, 5 years and 12 years (i.e. if a child has received all of their age appropriate immunisations by the time they have reached the milestone age they are fully immunised). Note: As the NIR only began collecting data in 2005, data for the 5+ year milestone ages are unavailable.

The following section summarises immunisation coverage for Pacific children in New Zealand using data from the National Immunisation Register. It concentrates on those immunisations which are offered in the Immunisation Schedule for all New Zealand children and does not include Meningococcal Disease (page 206), or Tuberculosis (page 213) for which immunisation is not universally recommended.

Data Source and Methods

Definition

Proportion of Children Fully Immunised at 6, 12, 18 and 24 months

Data Sources

Numerator: National Immunisation Register (NIR): Children on the NIR who reach the Milestone Age within the specified time period and who are fully immunised

Denominator: All children on the NIR who reach the Milestone Age within the specified time period

Notes on Interpretation

Note 1: The NIR is a computerised information system that records immunisation details for NZ children. Information is collected on all children born after a specified date, the birth cohort. This date varies by DHB as NIR implementation was rolled out during 2005 starting with Counties Manukau and Waitemata in April and culminating with Nelson Marlborough in December 2005. Babies born in maternity facilities have their details sent directly to the NIR from discharge data. For babies born at home, Lead Maternity Carers are requested to send information to the NIR. Migrant children and children born to New Zealand citizens overseas, whose date of birth falls within the birth cohort, are registered at their first point of contact with primary health care services. After an immunisation event, immunisation information is sent to the NIR by the provider electronically or via paper/fax. An individual or parent/caregiver may choose not to have any further health information collected on the NIR (i.e., they opt-off). When an individual chooses to opt-off the NIR, their NHI, date of birth, DHB, date of opting off and immunisation events recorded prior to opting-off are retained in order to provide an accurate denominator for coverage calculations [220].

Note 2: Tests of statistical significance have not been applied to the data in this section, and thus any associations described do not imply statistical significance or non-significance.

New Zealand Distribution

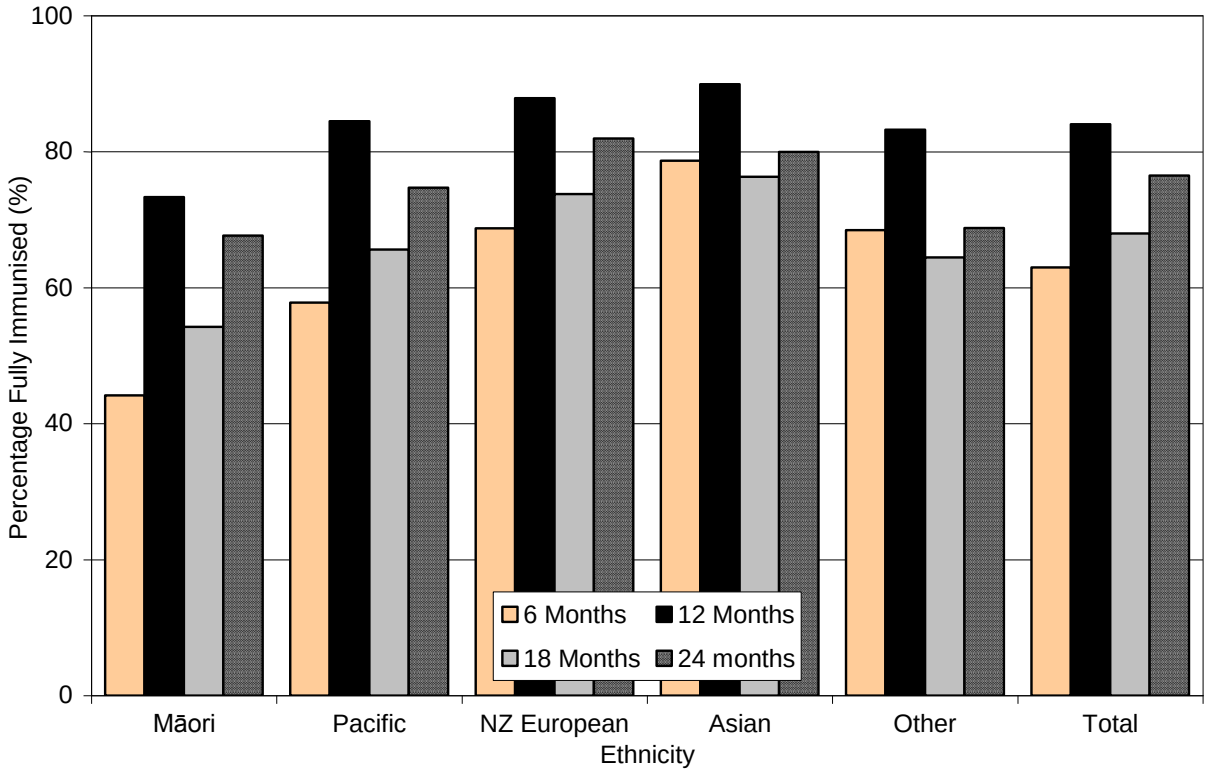
Age and Ethnicity

In New Zealand in the 12 months ending 30th June 2008, 57.8% of Pacific children were fully immunised at 6 months, 84.5% at 12 months, 65.6% at 18 months and 74.7% at 24 months, as compared to national coverage rates of 63% at 6 months, 84% at 12 months, 68% at 18 months and 76.5% at 24 months. Higher coverage rates at 12 months reflect that there are no additional immunisations scheduled between the 5 month vaccination and 12 months, thus allowing children time to "catch up" late vaccinations. A similar phenomenon occurs between 15 and at 24 months, potentially suggesting that a significant number of children are not receiving their vaccinations in a timely manner (**Figure 76**).

NZ Deprivation Index Decile

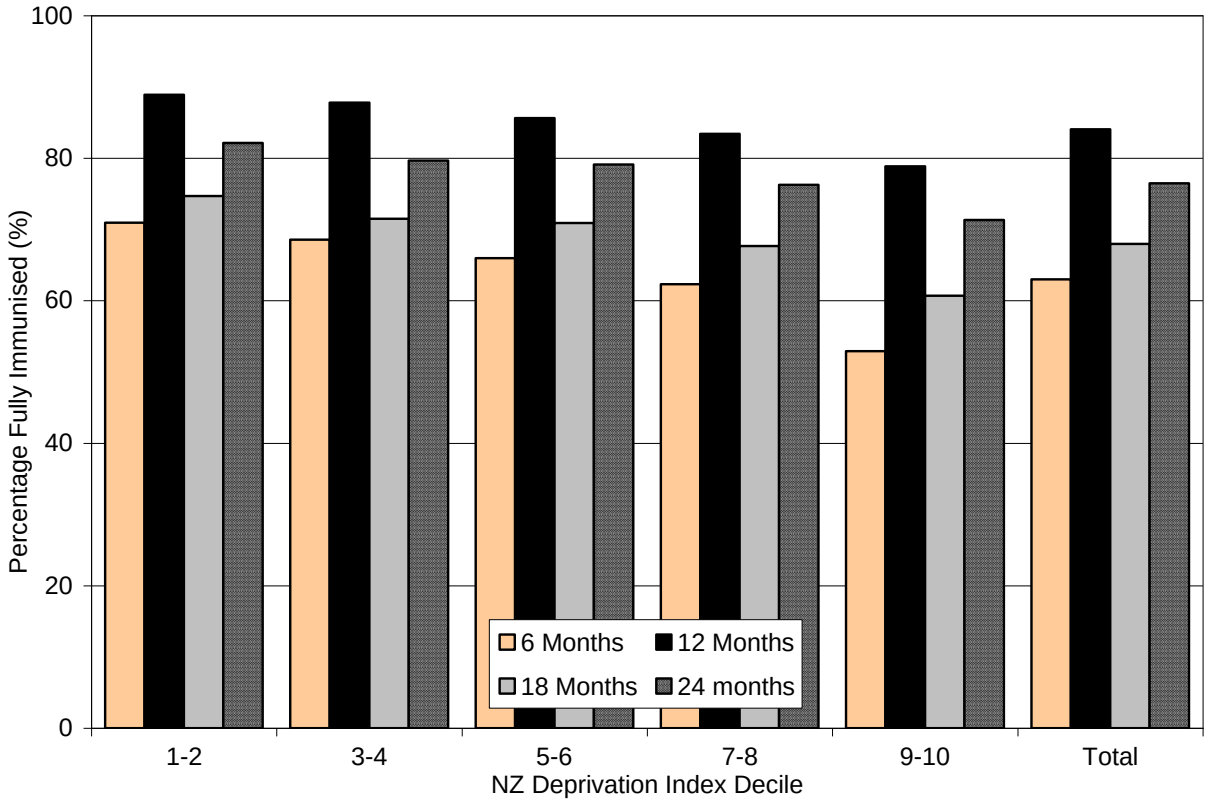
In New Zealand in the 12 months ending 30th June 2008, immunisation coverage at each milestone age was generally lower for those in the most deprived areas (NZDep decile 9-10) (**Figure 77**).

Figure 76. Immunisation Coverage for Children Enrolled on the National Immunisation Register by Milestone Age and Ethnicity, New Zealand 12 Months Ending 30 June 2008



Source: NIR. Note: Includes children enrolled on the NIR, who turned the milestone age within the period and who received all of their age appropriate immunisations.

Figure 77. Immunisation Coverage for Children Enrolled on the National Immunisation Register by Milestone Age and New Zealand Deprivation Index, New Zealand 12 Months Ending 30 June 2008



Source: NIR. Note: Includes children enrolled on the NIR, who turned the milestone age within the period and who had received all of their age appropriate immunisations.

Hospital Admissions for Pertussis in Infants <1 Year

Pertussis is a highly contagious, bacterial respiratory infection caused by the organism *Bordetella Pertussis*. Infection is droplet spread and occurs most commonly in unimmunised infants and children <4 years of age. The incubation period of 7-14 days is followed by 6-8 weeks of illness divided into 3 distinct stages: a catarrhal stage (10-14 days) associated with runny nose, sneezing and dry cough; a paroxysmal stage (4-6 weeks) associated with a paroxysmal cough often ending in an inspiratory whoop; and a convalescent stage (1-2 weeks) [202]. Pertussis is of particular concern if acquired during the first year of life, when mortality rates are at their highest [221]. While in New Zealand mortality has been low in recent years (0-1 deaths per year), morbidity remains high, with hospitalised infants often requiring oxygen, suction, (+/-) intubation during the paroxysmal phase [222].

Routine pertussis vaccination began in New Zealand in 1960, with the current schedule recommending vaccination at 6 weeks, 3 months and 5 months of age. Booster doses are recommended at 15 months and 4 years [221]. Yet, despite the widespread availability of vaccine, New Zealand's hospital admissions for pertussis are 5-10 times higher than those of England / Wales and the USA [222] and epidemics occur at regular 4-5 year intervals, the most recent beginning in late 2004 [223]. In addition, large ethnic differences also remain, with one recent review (n=110) noting pertussis admissions were 3.1 times higher for Pacific and 2.5 times higher for Māori infants than for European infants. The review also found that despite being more likely to be immunised, Pacific infants had higher admission rates, as the result of a larger proportion (45% vs.13%) acquiring pertussis ≤ 6 weeks of age [224].

Data Source and Methods

Definition
Hospital Admissions and Deaths due to Pertussis in Infants Aged <1 Year

Data Sources
Admissions Numerator: National Minimum Dataset: Hospital admissions for infants < 1 year with a primary diagnosis of Pertussis (ICD-9 033; ICD-10 A37)
Deaths Numerator: National Mortality Collection: Deaths in infants < 1 year where the main underlying cause of death (clinical code) was Pertussis (ICD-9 033; ICD-10 A37)
Denominator: Birth Registration Dataset

Notes on Interpretation
Note 1: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Note 2*: Appendix 4: The National Minimum Dataset* outlines the limitations of hospital admission data. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Indicator Category
Admissions: Proxy B; Mortality: Ideal B

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1990-2007, pertussis epidemics occurred at regular 3-4 year intervals, with the last epidemic occurring in 2004 (**Figure 78**).

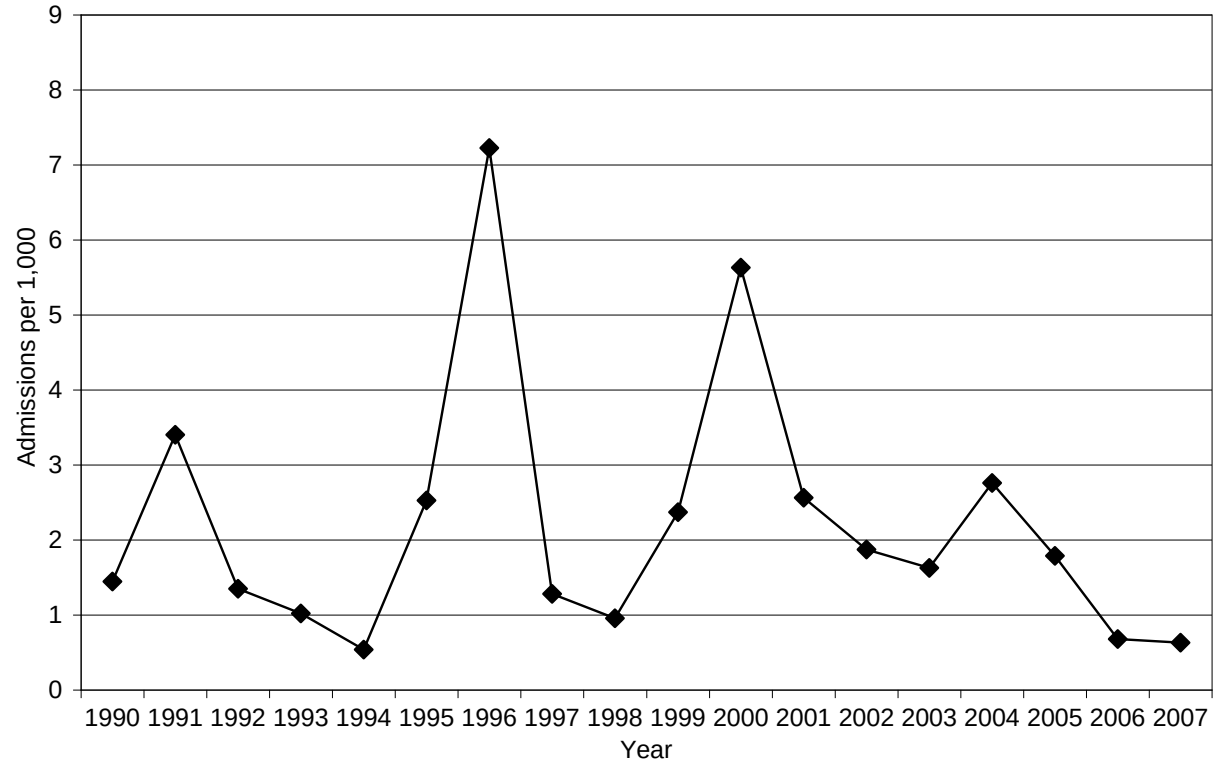
New Zealand Distribution by Age

In New Zealand during 2003-2007, the majority of pertussis admissions occurred in infants <1 year, with rates tapering off rapidly thereafter. Similarly, during 2001-2005 all pertussis deaths occurred in infants <1 year (**Figure 79**).

Distribution by Prioritised Ethnicity, NZDep Decile, Gender and Urban / Rural Location

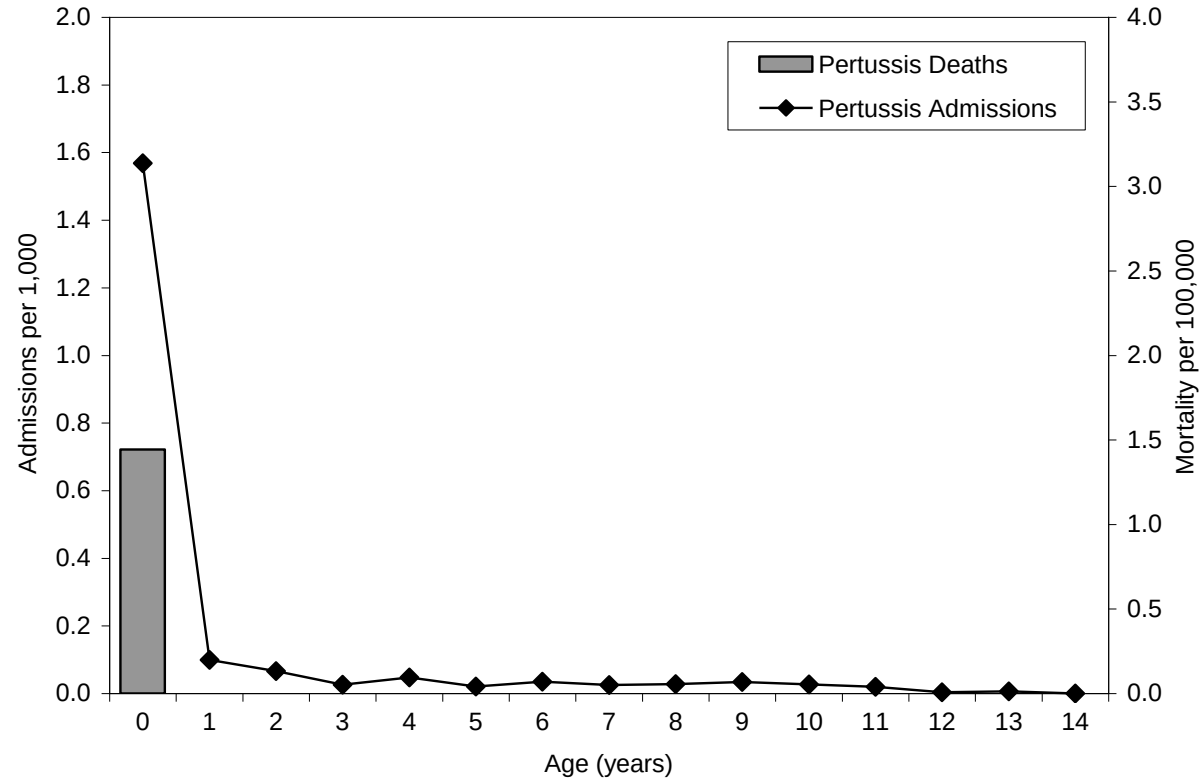
In New Zealand during 2003-2007, pertussis admissions in infants <1 year were *significantly higher* for Pacific and Māori > European > Asian infants, and those living in urban or deprived areas (**Table 61**). Similar ethnic differences were seen during 1996-2007, with admission rates being higher for Sole than for Any Pacific infants during this period (**Figure 80**).

Figure 78. Hospital Admissions for Pertussis in Infants <1 Year, New Zealand 1990-2007



Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset.

Figure 79. Hospital Admissions and Deaths due to Pertussis in Children 0-14 Years by Age, New Zealand 2003-2007 (Admissions) and 2001-2005 (Deaths)



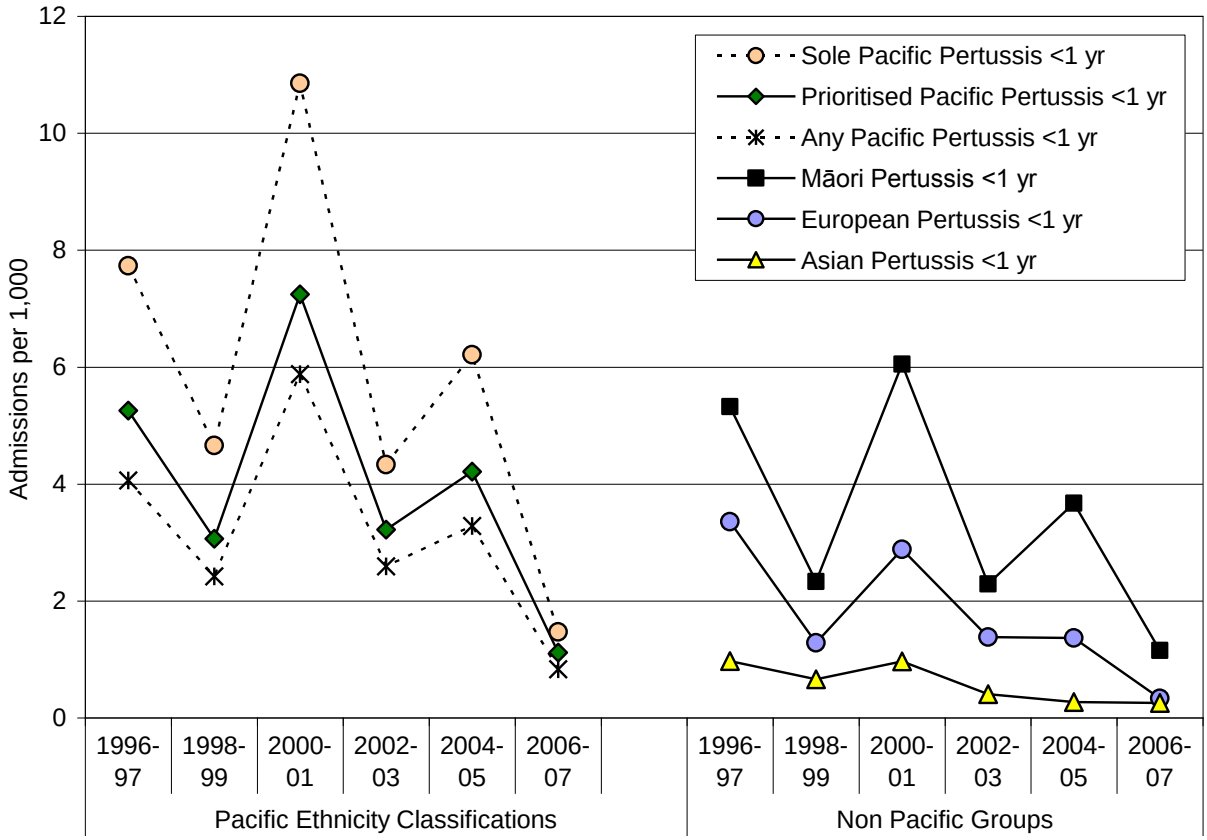
Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Birth Registration Dataset

Table 61. Risk Factors for Hospital Admissions due to Pertussis in Infants <1 Year, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	0.49	1.00		1-2	0.75	1.00	
2	1.00	2.04	1.00 - 4.16	3-4	0.69	0.92	0.58 - 1.47
3	0.85	1.73	0.83 - 3.60	5-6	1.14	1.52	1.00 - 2.29
4	0.56	1.14	0.52 - 2.48	7-8	1.31	1.74	1.18 - 2.58
5	1.32	2.69	1.36 - 5.32	9-10	2.77	3.68	2.57 - 5.25
6	1.00	2.04	1.02 - 4.06	Prioritised Ethnicity			
7	1.06	2.17	1.09 - 4.32	European	0.90	1.00	
8	1.51	3.08	1.61 - 5.89	Māori	2.28	2.52	2.02 - 3.14
9	2.27	4.63	2.47 - 8.68	Pacific	2.89	3.20	2.46 - 4.17
10	3.20	6.54	3.54 - 12.08	Asian	0.32	0.35	0.18 - 0.70
Gender				Urban / Rural			
Female	1.54	1.00		Urban	1.54	1.00	
Male	1.41	0.91	0.76 - 1.10	Rural	1.01	0.65	0.47 - 0.91

Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset. Note: Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Figure 80. Hospital Admissions for Pertussis in Infants <1 Year by Ethnicity, New Zealand 1996-2007

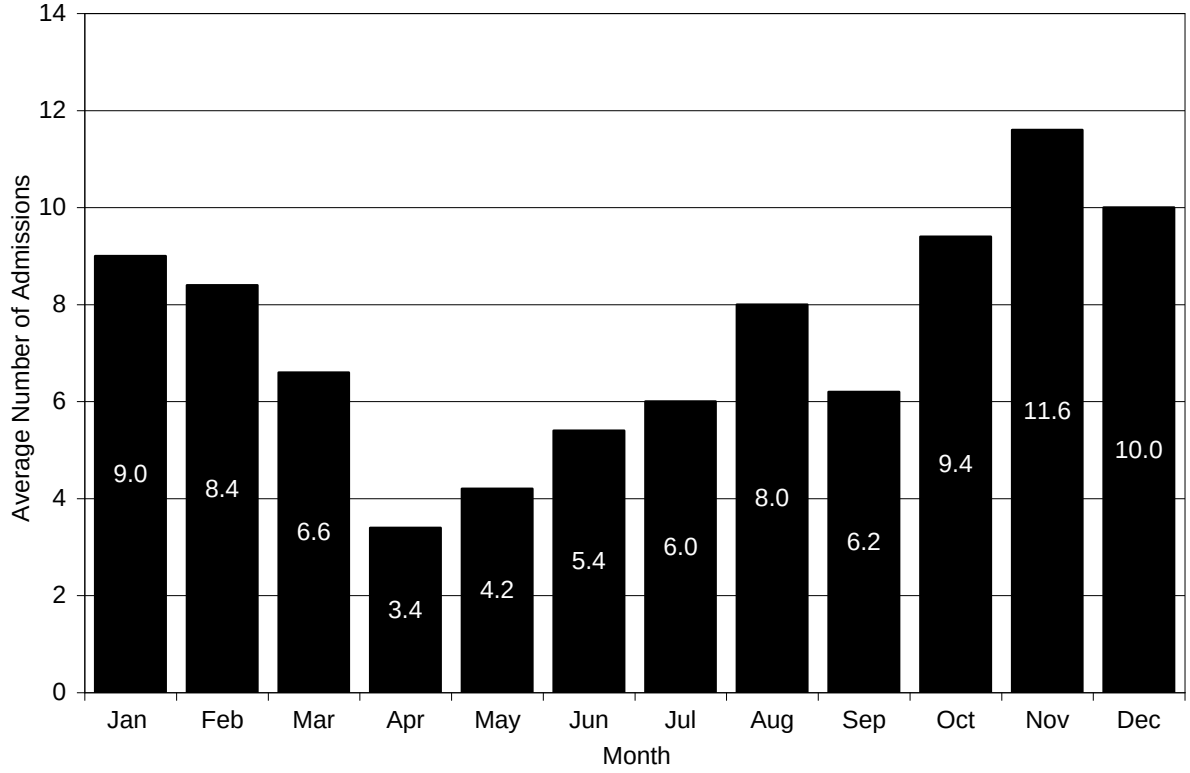


Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Distribution by Season

In New Zealand during 2003-2007, pertussis admissions were highest during the spring and summer months (**Figure 81**).

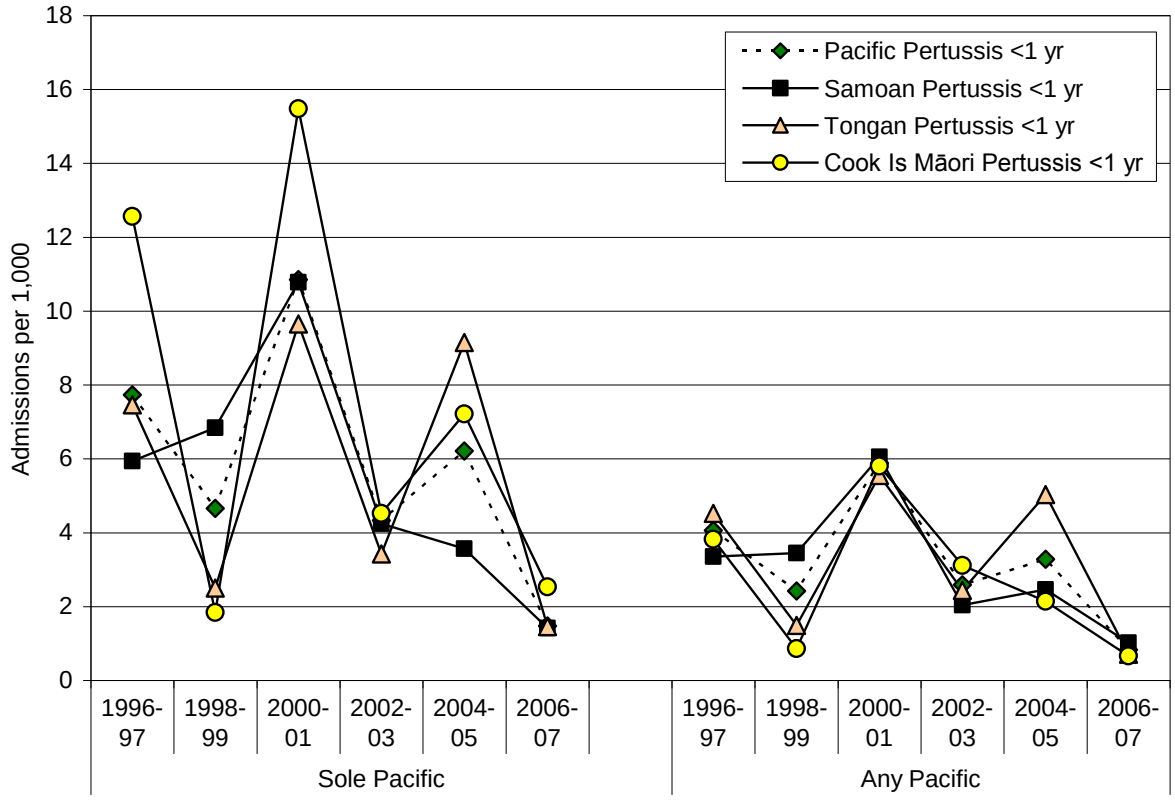
Figure 81. Average Number of Admissions for Pertussis per Month in Infants <1 Year, New Zealand 2003-2007



Source: National Minimum Dataset

Pertussis Admissions Amongst Pacific Groups in New Zealand

Figure 82. Hospital Admissions for Pertussis in Pacific Infants <1 Year by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any/Sole Classification (see page 333 for details).

Pacific Group Trends

During 1996-2007 (using the Sole / Any classification), there were no consistent differences in pertussis admissions between Samoan, Tongan and Cook Island Māori infants, either in the Sole or Any Categories (**Figure 82**).

Distribution by Pacific Group

During 2002-2006 (using the Sole / Any classification), pertussis admissions for Pacific infants were significantly higher than for non-Māori non-Pacific infants in each of the Sole and Any Groups (with the exception of Fijian, Tokelauan and Other Pacific infants, where small numbers prevented a valid comparison). Within the Any and Sole categories however, the majority of differences between individual Pacific groups did not reach statistical significance (**Table 62**).

Table 62. Distribution of Hospital Admissions due to Pertussis in Pacific Infants < 1 Year by Pacific Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	42	8.4	1.83	2.19	1.56-3.09
Any Tongan	28	5.6	2.78	3.33	2.23-4.98
Any Cook Island Māori	20	4.0	1.86	2.22	1.40-3.55
Any Niuean	9	1.8	2.28	2.73	1.39-5.34
Any Fijian	0	0.0	-	-	-
Any Tokelauan	<5	s	s	s	s
Any Other Pacific	<5	s	s	s	s
Any Pacific	100	20.0	2.21	2.64	2.05-3.40
Any Māori	197	39.4	2.28	2.73	2.21-3.37
Non-Māori Non-Pacific	151	30.2	0.84	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	30	6.0	3.00	3.59	2.42-5.30
Sole Tongan	25	5.0	4.96	5.94	3.89-9.05
Sole Cook Island Māori	15	3.0	5.24	6.28	3.70-10.65
Sole Niuean	7	1.4	12.75	15.26	7.19-32.41
Sole Fijian	0	0.0	-	-	-
Sole Tokelauan	0	0.0	-	-	-
Sole Other Pacific	<5	s	s	s	s
Sole Pacific	81	16.2	4.11	4.92	3.76-6.44
Sole Māori	159	31.8	4.83	5.78	4.63-7.22
Non-Māori Non-Pacific	151	30.2	0.84	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Birth Registration Dataset; Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted; s: rates not calculated due to small numbers.

Hospital Admissions and Notifications for Other VPDs

In New Zealand all infectious diseases in the routine immunisation schedule are notifiable under the Health Act 1956 and the Tuberculosis Act 1948. Notifications are recorded on a computerised database (EpiSurv) which sends data to the ESR on a weekly basis. Additional data are collected for some notifiable diseases via laboratory-based surveillance and the NZ Paediatric Surveillance Unit (polio and congenital rubella). Finally, a small amount of information is available from the National Minimum Dataset, on the number of children and young people being admitted to hospital for vaccine preventable diseases.

Data Source and Methods

Definition

1. *Notifications for Vaccine Preventable Diseases in Children and Young People Aged 0-19 Years*
2. *Hospital Admissions for Vaccine Preventable Diseases in Children and Young People Aged 0-24 Years*

Data Sources

1. *Notifications for Vaccine Preventable Diseases (VPD) in Children and Young People Aged 0-19 Years*

Numerator: Institute of Environmental Science and Research (ESR) Notifications for Diphtheria, Tetanus, Pertussis, Poliomyelitis, Hepatitis B, *Haemophilus influenzae* type b, Measles, Mumps, and Rubella.
Denominator: NZ Census
Interpretation: All infectious diseases in New Zealand's immunisation schedule are notifiable under the Health Act 1956 or the Tuberculosis Act 1948. Notifications are recorded on a computerised database (EpiSurv) which sends data to the ESR on a weekly basis. An assessment of the system's sensitivity was made in 2003 using meningococcal disease data. This suggested a sensitivity for meningococcal disease of >87%, although the system is inherently less sensitive for chronic infections e.g. hepatitis B [225].

2. *Hospital Admissions for Vaccine Preventable Disease (VPD) in Children and Young People Aged 0-24 Years*

Numerator: National Minimum Dataset: Hospital Admissions for VPDs including Pertussis (A37); Tetanus (A33-35); Diphtheria (A36); Polio (A80); Acute Hepatitis B (B16); Measles (B05); Mumps (B26); Rubella (B06, M01.4, P35.0).
Denominator: NZ Census
Interpretation: Hospital admissions for *Haemophilus influenzae* were not included as current vaccines only cover *Haemophilus influenzae* type B and type is seldom specified in hospital admission data. Similarly admissions for *Streptococcus pneumoniae* were not included as vaccine roll out only began during 2008.

Notes on Interpretation

Tests of statistical significance have not been applied to the data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category Notifications and Admissions: Proxy B; Mortality: Ideal B.

Hospital Admissions for VPDs

In New Zealand during 2003-2007, there were 738 hospital admissions for children and young people 0-24 years with (routine) vaccine preventable diseases. Of these, 77.5% were due to Pertussis (**Table 63**). Hospital admissions however, are most likely to represent the severe end of the spectrum, and thus to underestimate the true burden of VPDs in the child and youth population. In addition, admissions for *Haemophilus Influenzae* Type B and pneumococcal disease are difficult to identify using routine hospital admission data.

Table 63. Hospital Admissions for Selected Vaccine Preventable Diseases in Children and Young People 0-24 Years, New Zealand 2003-2007

VPD	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	% of total
Pertussis	572	114.4	8.05	77.5
Chronic Hepatitis B	85	17.0	1.20	11.5
Acute Hepatitis B	30	6.0	0.42	4.1
Mumps	27	5.4	0.38	3.7
Measles	18	3.6	0.25	2.4
Rubella	4	0.8	0.06	0.5
Tetanus	2	0.4	0.03	0.3
Total	738	147.6	10.38	100.0

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Includes only VPDs on the Routine Immunisation Schedule (i.e. Meningococcal disease excluded); During 2003-2007 there were no admissions for Diphtheria or Polio; *Haemophilus Influenzae* is not identified by type in hospital admission data and thus (vaccine preventable)*Type B* admissions cannot be distinguished from other Haemophilus Influenzae admissions.

Notifications for VPDs

In New Zealand during 2003-2007, 4695 cases of (routine) VPD were notified to ESR in children and young people aged 0-19 years (**Table 63**). Pertussis was the most frequently notified VPD followed by mumps, measles, and rubella. (Note: Meningococcal disease was excluded on the basis that it is no longer part of New Zealand's routine vaccine schedule).

Table 64. Notifications for Selected Vaccine Preventable Diseases in Children and Young People 0-19 Years, New Zealand 2003-2007

VPD	Number of Notifications					Total 2003-07	Annual Average	Rate per 100,000
	2003	2004	2005	2006	2007			
Pertussis	433	2,065	1,236	354	129	4,217	843.4	72.91
Mumps	40	31	45	34	51	201	40.2	3.48
Measles	60	29	19	19	20	147	29.4	2.54
Rubella	24	23	13	7	10	77	15.4	1.33
Hib	8	<5	<5	7	11	26	5.2	0.45
Acute Hepatitis B	5	<5	5	5	4	19	3.8	0.33
Tetanus	0	0	0	<5	0	<5	s	s
Diphtheria	0	0	0	0	0	0	s	s
Poliomyelitis	0	0	0	0	0	0	0	0.00
Total	570	2,151	1,322	427	225	4,695	939	81.17

Source: ESR [226]. Note: Includes only Vaccine Preventable Diseases on the Routine Immunisation Schedule (i.e. Meningococcal disease is excluded); Rate is per 100,000 per year. Hib: *Haemophilus influenzae* type b. No cases of poliomyelitis occurred during 2003-2007.

Summary

Vaccine Coverage: In New Zealand in the 12 months ending 30th June 2008, 57.8% of Pacific children were fully immunised at 6 months, 84.5% at 12 months, 65.6% at 18 months and 74.7% at 24 months of age, as compared to national coverage rates of 63% at 6 months, 84% at 12 months, 68% at 18 months and 76.5% at 24 months. Higher coverage rates at 12 months reflect that there are no additional immunisations scheduled between the 5 month vaccination and 12 months, thus allowing children time to "catch up" late vaccinations. A similar phenomenon occurs between 15 and at 24 months, potentially suggesting that a significant number of children are not receiving their vaccinations in a timely manner.

Pertussis Admissions: In New Zealand during 1990-2007, pertussis epidemics occurred at regular 3-4 year intervals, with the last epidemic occurring in 2004. During 2003-2007, pertussis admissions were *significantly higher* for Pacific and Māori > European > Asian infants, and those living in urban or deprived areas. When broken down by age, the majority of pertussis admissions and all recent deaths were in infants <1 year.

During 2002-2006 (using the Sole / Any classification), pertussis admissions for Pacific infants were significantly higher than for non-Māori non-Pacific infants in each of the Sole and Any Groups (with the exception of Fijian, Tokelauan and Other Pacific infants, where small numbers prevented a valid comparison). Within the Any and Sole categories however, the majority of differences between individual Pacific groups did not reach statistical significance.

Other Vaccine Preventable Diseases: In New Zealand during 2003-2007, there were 738 hospital admissions for children and young people 0-24 years with (routine) vaccine preventable diseases. Of these, 77.5% were due to Pertussis. During the same period, 4,695 cases of (routine) VPD were notified to the ESR for those aged 0-19 years. Pertussis was the most frequently notified VPD followed by mumps, measles, and rubella.

Local Policy Documents and Evidence Based Reviews Relevant to Immunisation Coverage

Improving immunisation coverage has been identified as one of the Ministry of Health's ten Health Targets. In New Zealand at present, there are a number of policy documents which provide information to health professionals on vaccine preventable diseases, vaccine schedules and strategies to improve coverage rates at the local practice level. In addition, there are a large number of evidence based reviews in the international literature, which consider the effectiveness of interventions to increase immunisation coverage rates. These publications are briefly reviewed in **Table 65**.

Table 65. Local Policy Documents and Evidence Based Reviews Relevant to Increasing Immunisation Coverage

Ministry of Health Policy Documents
Minister of Health. **Health Targets: Moving Towards Healthier Futures 2007/2008**. 2007, Ministry of Health. Wellington. http://www.MOH.govt.nz/MOH.nsf/pagesmh/6635/$File/health-targets-aug07.pdf Improving immunisation coverage has been identified as one of the Ministry of Health's ten Health Targets. This document provides a brief overview of how the Ministry envisages immunisation rates being improved, including consulting with local stakeholder groups, using the National Immunisation Register to recall children and providing outreach services to reach those not accessing immunisations.
Ministry of Health. **Review of Neonatal BCG Immunisation Services in New Zealand**. 2007, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/indexmh/review-of-neonatal-bcg-immunisation-services This document reviews New Zealand's current BCG immunisation programme and highlights a number of issues with the current programme delivery particularly around the quality of data collection. It makes a number of recommendations about contracts, monitoring, resources required and surveillance.
Ministry of Health. **Immunisation Handbook**. 2006, Wellington: Ministry of Health. http://www.MOH.govt.nz/MOH.nsf/indexmh/immunisation-handbook-2006 The Immunisation Handbook provides information for health professionals on vaccine preventable diseases and vaccine availability, as well as practical advice and strategies for health professionals immunising children and adults in New Zealand. There is a 2008 National Immunisation Schedule Health provider booklet that contains information on the 2008 immunisation schedule and should be used in conjunction with the 2006 Handbook [219].
Ministry of Health. **Immunisation in New Zealand-Strategic Directions 2003-2006**. 2003, Ministry of Health; Wellington http://www.MOH.govt.nz/MOH.nsf/82f4780aa066f8d7cc2570bb006b5d4d/560a6eac4eb56ed9cc256e120076232a/$FILE/ImmunisationInNZ.pdf This document identifies implementing a National Immunisation Register (NIR) and the Meningococcal B immunisation programme as two priorities; both of which have now been achieved. It also identifies improving access to immunisation services through primary care and outreach programmes, and improving communication strategies for immunisation as key components for child health. A number of supportive strategic strategies are also identified.
Systematic and Other Reviews from the International Literature
Jacobson Vann J, Szilagyi P. **Patient Reminder and Recall Systems to Improve Immunisation Rates**. Cochrane Database of Systematic Reviews 2005, Issue 3. This review of 47 studies found that reminding people to have vaccinations increased the number of people vaccinated, whether the people were due or overdue for vaccinations. The increases were observed in both children and adults for all types of vaccines, but not among urban adolescents in one study. Reminding people over the telephone, sending a letter or postcard, or speaking to them in person increased vaccinations. Providing numerous reminders was more effective than single reminders. Reminding people by telephone was more effective than postcard or letter reminders, but may be expensive compared with alternative approaches. Reminders also worked whether they were from a private doctor's office, a medical centre, or a public health department clinic.

Whittaker K. **Lay Workers for Improving the Uptake of Childhood Immunisation**. British Journal of Community Nursing, 2002. 7(9):474-479.

This review considered whether the involvement of lay workers in community child health services was effective in improving the uptake of childhood immunisation. The review identified two randomised controlled trials and concluded that lay intervention may be effective in increasing immunisation uptake.

Rentier B, Gershon A, European Working Group on Varicella (EuroVar). **Consensus: Varicella Vaccination of Healthy Children - A Challenge for Europe.** Pediatric Infectious Disease Journal, 2004. 23(5):379-89.

After a series of meetings, EuroVar members prepared a consensus statement recommending routine varicella vaccination for all healthy children between 12-18 months and all susceptible children before their 13th birthday (in addition to catch-up vaccination in older children and adults with no reliable history of varicella and who were at high risk of exposure). However, such a policy was recommended only if a very high coverage rate could be achieved (e.g. with a MMR-varicella combined vaccine).

Briss P, Rodewald L, Hinman A, et al. **Reviews of Evidence Regarding Interventions to Improve Vaccination Coverage in Children, Adolescents, and Adults**. American Journal of Preventive Medicine. 2000. 18(1 Supplement):97-140.

This review examined the effectiveness, applicability, economic impact, and barriers to use of population-based interventions to improve vaccination coverage. It concluded that:

1. **Client Reminder / Recall Interventions** were strongly recommended on the basis of strong scientific evidence that they improve vaccination coverage: in children and adults; in a range of settings and populations; when applied at different levels of scale from individual practice to entire communities; across a range of intervention characteristics; and whether used alone or as part of a multi-component intervention.
2. **Multi-Component Interventions that Include Education** were strongly recommended on the basis of strong scientific evidence that they improve vaccination coverage in children and adults, in community-wide and clinic based settings, in a range of contexts, and have incorporated education with a variety of other activities.
3. **Vaccination Requirements for Childcare, School, and College Attendance** were recommended on the basis of sufficient scientific evidence that: these requirements are effective in reducing vaccine-preventable disease and / or improving vaccination coverage; and are effective in all relevant populations.
4. **Reducing Out-of-Pocket Costs** are strongly recommended on the basis that they improve vaccination coverage in children and adults, in a range of settings and populations, when applied at different levels of scale from individual clinical settings to national efforts, and whether used alone or as part of a multi-component intervention.
5. **Expanding Access in Health Care Settings**: as part of multi-component interventions expanding access is strongly recommended on the basis it improves vaccination coverage in children and adults in a range of contexts. Insufficient evidence exists on the effectiveness of expanded access alone.
6. **Vaccination Programmes in Women, Infants, and Children Settings** are recommended on the basis that they improve vaccination coverage in children whether used alone or as part of a multi-component intervention.
7. **Home Visits** are recommended on the basis that they improve vaccination coverage. When applied only to improve vaccination coverage, home-visiting can be highly resource intensive relative to other options.
8. **Assessment and Feedback for Vaccination Providers** are strongly recommended on the basis that they improve vaccination coverage: in children and adults; in a range of settings and populations; whether used alone or as part of multi-component interventions.
9. **Standing Orders to Vaccinate Adults** are strongly recommended on the basis that they improve vaccination coverage whether used alone or as part of a multi-component intervention and are effective in such settings as hospitals, clinics, and nursing homes. Insufficient evidence exists regarding the effectiveness of standing orders in children.
10. **Available studies provided insufficient evidence for** community-wide, education-only interventions, clinic-based, education-only interventions, client or family incentives, client-held medical records, vaccination programmes in schools or childcare centres, or provider education only.

Task Force on Preventative Services. **Recommendations Regarding Interventions to Improve Vaccination Coverage in Children, Adolescents and Adults**. Journal of Preventive Medicine, 2000. 18(Supplement 1): p. 92-96.

The Task force of Preventative Services also made recommendations based on the review by Briss et al [227] as presented above.

Bordley W, Chelminski A, Margolis P, et al. **The Effect of Audit and Feedback on Immunisation Delivery: A Systematic Review**. American Journal of Preventive Medicine, 2000.18(4):343-350

This review assessed the effectiveness of audit and feedback on immunisation delivery by health professionals. The review looked at childhood and adult immunisation. For children 5 studies were identified and in general these studies demonstrated a positive association, although the number and quality of studies identified was limited. Only two studies examined the effect of audit and feedback as the sole intervention, and it is therefore, difficult to evaluate the independent effect of audit and feedback and the magnitude of its effect on childhood immunisation rates.

Kendrick D, Hewitt M, Dewey M, et al. **The Effect of Home Visiting Programmes on Uptake of Childhood Immunisation: A Systematic Review and Meta-Analysis**. Journal of Public Health Medicine, 2000. 22(1):90-98

This review evaluated the effectiveness of home visiting on the uptake of childhood immunisation and found home visiting programmes were not effective in increasing immunisation uptake (Note: the studies reviewed provided maternal support but not immunisation at home). These findings suggest that multi-faceted home visiting programmes are not sufficient to increase uptake, and that more specific interventions may be required to achieve this.

Contributors to the Cochrane Collaboration and the Campbell Collaboration. **Evidence from Systematic Reviews of Research Relevant to Implementing the 'Wider Public Health' Agenda.** Centre for Reviews and Dissemination, 2000. http://www.york.ac.uk/inst/crd/wph.htm

The *Wider Public Health* microsite has a specific section looking at strategies to increase immunisation rates which includes a summary of the systematic reviews in this area and the implications of these for public health policy and practice. The document above has been updated on the website with specific information not included in the original document (cited above) and can be accessed at: http://www.crd.york.ac.uk/wph/us.cgi?Product=WPH1&Action=GetPackage&Package=000001&Guest=Yes&DisplayForEdit=Yes

Guide to Community Preventive Services. Systematic Reviews and Recommendations. **Vaccine-Preventable Diseases: Improving Coverage in Children, Adolescents and Adults**. 2003. http://www.thecommunityguide.org/vaccine/Vaccine-Preventable-Diseases.pdf.

These recommendations are based on the findings of the review by Briss et al (2000) outlined above[227]. Other reference documents are available at http://www.thecommunityguide.org /vaccine

Other Relevant / Forthcoming Documents

Middleman A. Adolescent Immunisations: **Policies to Provide a Shot in the Arm for Adolescents**. Journal of Adolescent Health, 2007. 41(2):109-18.

With multiple vaccines for adolescents recently recommended and in various stages of development, the issue of how to effectively deliver immunisations to this age group has become increasingly important. This document addresses some of the primary barriers and potential public health solutions to providing vaccinations effectively to adolescents. The foreseen complexities associated with each potential solution will be noted throughout; there remain potentially unforeseen ramifications as well.

National Institute for Health and Clinical Excellence: **Reducing Differences in Uptake of Immunisation.** http://www.nice.org.uk/guidance/index.jsp?action=byID&o=10988

Currently under development by NICE. The final document is due in June 2009 and will provide public health guidance about on mechanisms to reduce inequalities in the uptake of immunisations in those under 19 years.

Meningococcal Disease

Introduction

Neisseria meningitidis is a non-motile gram-negative diplococcus (bacteria) frequently found in the nose and throat of asymptomatic carriers. Symptoms of invasive disease include fever, headache, drowsiness, irritability, vomiting and a petechial rash. Without appropriate antibiotic treatment, death from septicaemia or meningitis may occur within a relatively short period of time (hours). While meningococcal infections are only moderately communicable, crowded conditions concentrate the number of carriers and may reduce individual resistance to the organism [202].

During the 1990s it became apparent that New Zealand was in the midst of an epidemic of serogroup B meningococcal disease, with rates increasing markedly after 1991. The majority of this increase was amongst Pacific and Māori families, with evidence of cases clustering in suburbs with a high proportion of Pacific and Māori families with young children [228]. Early Ministry of Health prevention strategies focused on epidemiological surveillance, public awareness campaigns, contact tracing and the offering of prophylactic antibiotics. Clinical trials of a tailor-made meningococcal B vaccine began in 2002 however, and following regulatory approval in July 2004, roll out of the MeNZB Vaccine occurred across the country (for those 6 months-19 years) during 2004-2005 [229]. Following a large reduction in the number of cases (235 epidemic strain cases in 1997, rising to 370 in 2001 and then falling to 47 in 2007 [230]) the MeNZB vaccine programme was discontinued in June 2008 (although free vaccine is still available to those at high medical risk (e.g. asplenia, lab workers)) [231].

The following section explores meningococcal disease rates amongst Pacific children and young people in New Zealand using information from the National Minimum Dataset and Mortality Collection. The section concludes with a review of policy and evidence based review documents which consider interventions to address meningococcal disease at the population level.

Data Source and Methods

Definition

Hospital Admissions and Deaths due to Meningococcal Disease in Children and Young People Aged 0-24 years

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions of children and young people (0-24 years) with a primary diagnosis of Meningococcal Disease (ICD-9 036; ICD-10 A39)

Deaths Numerator: National Mortality Collection: Deaths in children and young people (0-24 years) where the main underlying cause of death (clinical code) was Meningococcal Disease (ICD-9 036; ICD-10 A39)

Denominator: NZ Census

Notes on Interpretation

Note 1: *Appendix 4: The National Minimum Dataset* outlines the limitations of hospital admission data. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category Admissions: Proxy B; Mortality: Ideal B

New Zealand Distribution and Trends

New Zealand Trends and Age Distribution

During the 1990s New Zealand experienced large increases in hospital admissions and mortality from meningococcal disease, with rates peaking in the late 1990s-early 2000s. Since 2002-2003 however, both admissions and mortality have declined (**Figure 83**). During 2003-2007, meningococcal disease admissions were highest in children <5 years, although a smaller peak also occurred amongst those in their late teens (**Figure 84**).

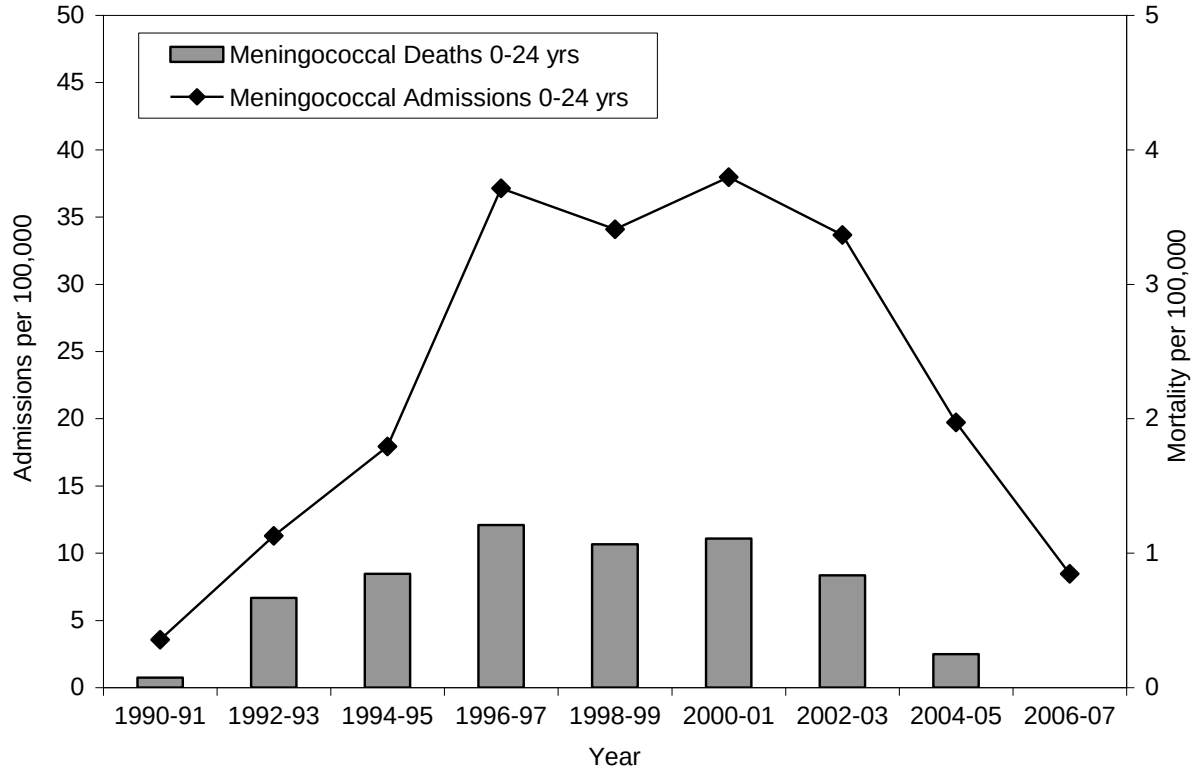
Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

During 2003-2007, hospital admissions for meningococcal disease were *significantly* higher for Pacific > Māori > European > Asian children and young people, males and those living in urban or deprived areas (**Table 66**). During 1996-2007, while hospital admissions for meningococcal disease declined for all ethnic groups, in absolute terms declines were greater for Pacific, followed by Māori children and young people. Throughout this period, admissions were higher for Sole than for Any Pacific children and young people (**Figure 85**).

Distribution by Season

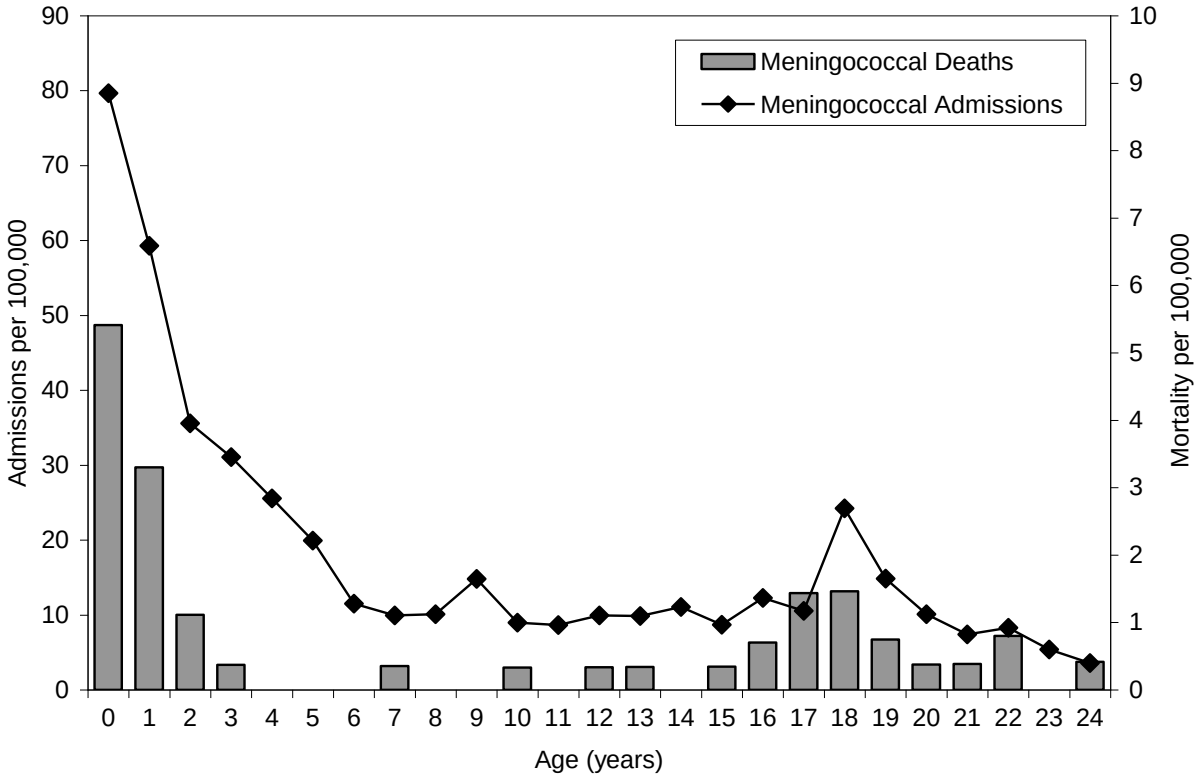
In New Zealand during 2003-2007, hospital admissions for meningococcal disease were highest during winter and early spring (**Figure 86**).

Figure 83. Hospital Admissions (1990-2007) and Deaths (1990-2005) due to Meningococcal Disease in New Zealand Children and Young People 0-24 Years



Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census. Note: Mortality data unavailable for 2006-07.

Figure 84. Hospital Admissions and Deaths due to Meningococcal Disease in Children and Young People 0-24 Years by Age, New Zealand 2003-07 (Admissions) and 2001-05 (Deaths)



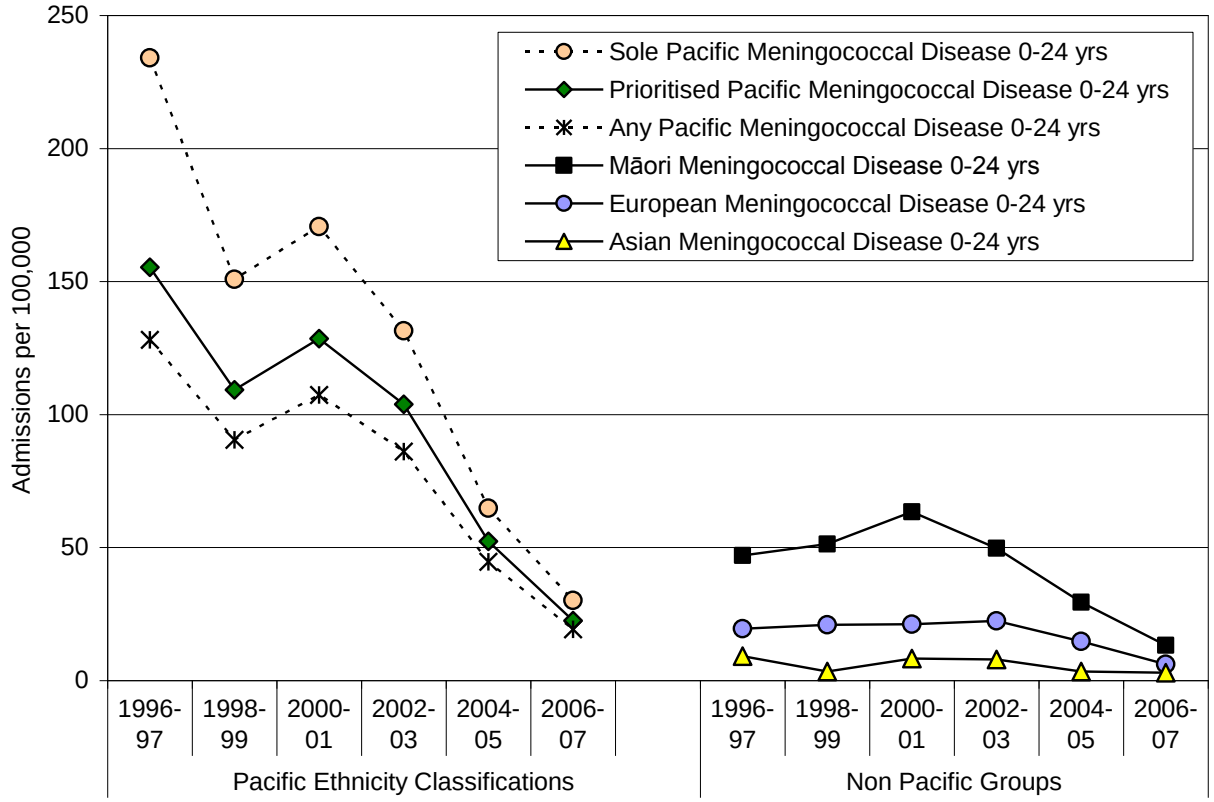
Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census

Table 66. Risk Factors for Hospital Admission due to Meningococcal Disease in Children and Young People 0-24 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	8.10	1.00		1-2	7.43	1.00	
2	6.75	0.83	0.56 - 1.24	3-4	8.78	1.18	0.90 - 1.54
3	7.21	0.89	0.60 - 1.31	5-6	10.91	1.47	1.14 - 1.89
4	10.38	1.28	0.90 - 1.83	7-8	21.43	2.88	2.30 - 3.62
5	12.65	1.56	1.11 - 2.20	9-10	35.28	4.75	3.84 - 5.87
6	9.21	1.14	0.79 - 1.64	Prioritised Ethnicity			
7	18.03	2.23	1.62 - 3.06	European	12.42	1.00	
8	24.67	3.05	2.25 - 4.12	Māori	26.86	2.16	1.90 - 2.47
9	28.75	3.55	2.65 - 4.76	Pacific	54.21	4.37	3.79 - 5.03
10	41.18	5.08	3.83 - 6.75	Asian	3.66	0.30	0.20 - 0.44
Gender				Urban / Rural			
Female	16.17	1.00		Urban	18.67	1.00	
Male	19.56	1.21	1.08 - 1.35	Rural	12.49	0.67	0.55 - 0.81

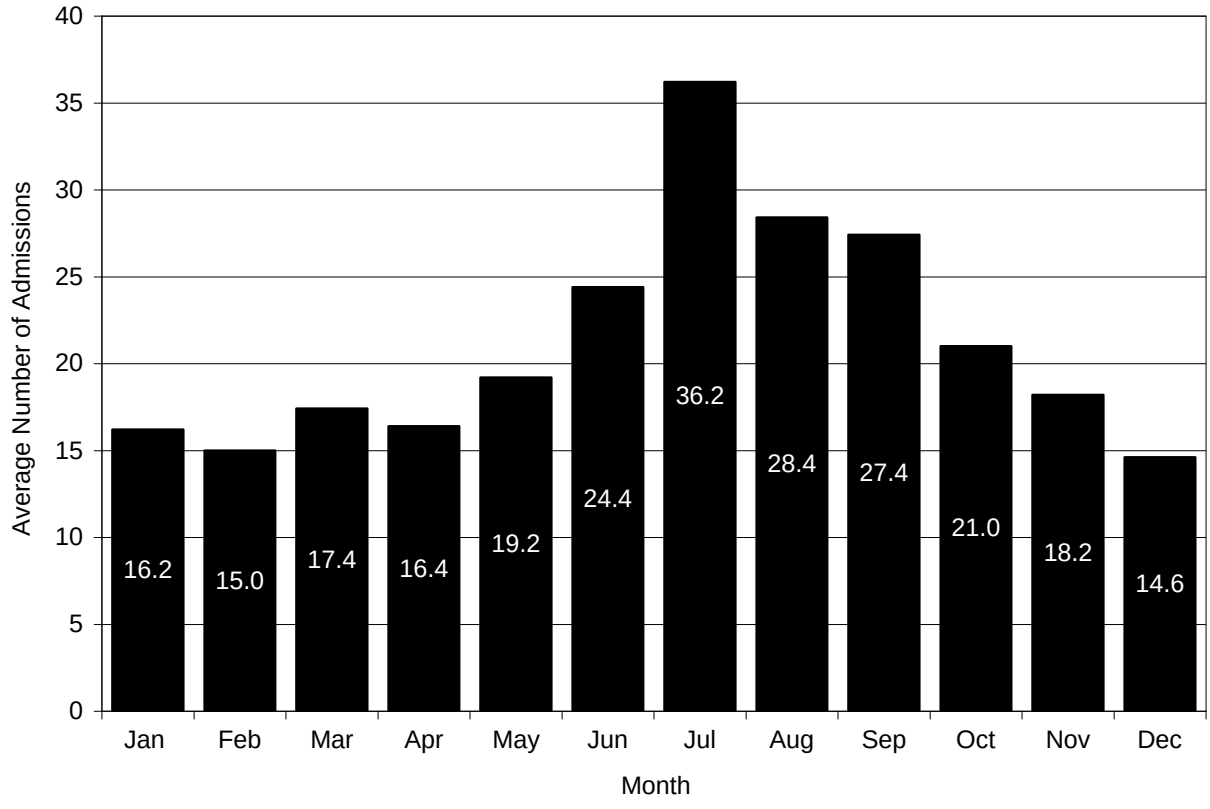
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Figure 85. Hospital Admissions for Meningococcal Disease in Children and Young People 0-24 Years by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 86 Average Number of Hospital Admissions for Meningococcal Disease per Month in Children and Young People 0-24 Years, New Zealand 2003-2007



Source: National Minimum Dataset

Meningococcal Disease Amongst Pacific Groups in New Zealand

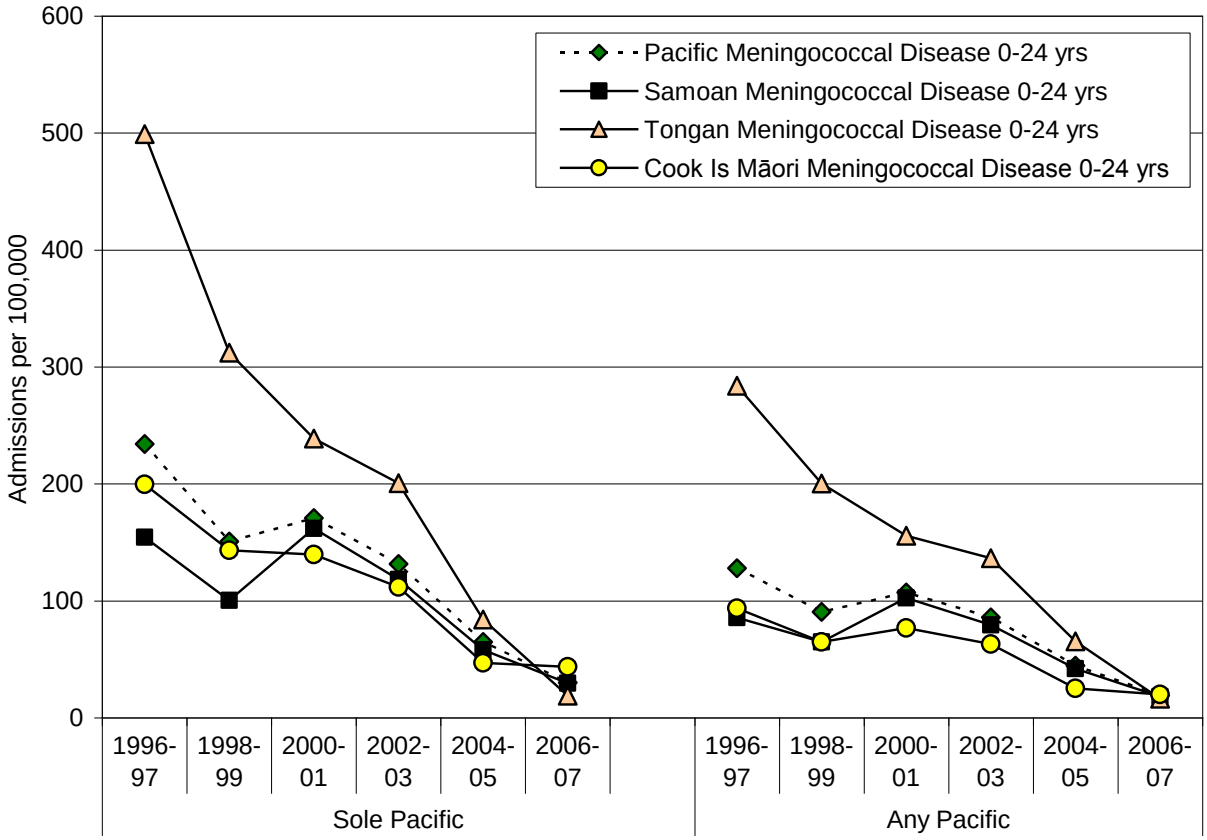
Pacific Group Trends

During the mid-late 1990s (using the Sole / Any classification), meningococcal disease admissions were higher for Tongan than for Samoan or Cook Island Māori children and young people (in both the Sole and Any categories). Differences decreased during the late-1990s and early 2000s however, so that by 2006-07 rates were similar for all three Pacific groups (**Figure 87**).

Distribution by Pacific Group

During 2003-2007 (using the Sole / Any classification), meningococcal disease admissions for Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of Tokelauan and Sole Fijian children and young people, where small numbers precluded a valid comparison). Within the Any Category, admissions were *significantly higher* for Tongan than for Cook Island Māori and Niue children and young people, although differences between groups in the Sole Category were less marked (**Table 67**).

Figure 87. Hospital Admissions for Meningococcal Disease in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Table 67. Distribution of Hospital Admissions due to Meningococcal Disease in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Any Samoan	152	30.4	42.21	3.79	3.17-4.53
Any Tongan	88	17.6	61.09	5.48	4.38-6.87
Any Cook Island Māori	57	11.4	33.39	3.00	2.28-3.94
Any Niuean	20	4.0	30.82	2.77	1.77-4.32
Any Fijian	8	1.6	33.46	3.00	1.50-6.04
Any Tokelauan	<5	s	s	s	s
Any Other Pacific	12	2.4	53.99	4.85	2.74-8.58
Any Pacific	328	65.6	45.15	4.05	3.54-4.64
Any Māori	401	80.2	26.86	2.41	2.12-2.74
Non-Māori Non-Pacific	562	112.4	11.14	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Sole Samoan	123	24.6	61.80	5.55	4.57-6.74
Sole Tongan	72	14.4	81.84	7.35	5.75-9.39
Sole Cook Island Māori	46	9.2	66.65	5.98	4.43-8.08
Sole Niuean	12	2.4	74.59	6.70	3.78-11.86
Sole Fijian	<5	s	s	s	s
Sole Tokelauan	<5	s	s	s	s
Sole Other Pacific	9	1.8	91.10	8.18	4.23-15.80
Sole Pacific	269	53.8	67.78	6.08	5.26-7.04
Sole Māori	327	65.4	48.36	4.34	3.79-4.98
Non-Māori Non-Pacific	562	112.4	11.14	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted; s: Rate not calculated due to small numbers.

Summary

During the 1990s New Zealand experienced large increases in admissions and mortality from meningococcal disease, with rates peaking during the late 1990s-early 2000s. Since 2002-2003 however, both admissions and mortality have declined. During 2003-2007, meningococcal disease admissions were *significantly* higher for Pacific > Māori > European > Asian children and young people, males and those living in urban or deprived areas. While admissions declined for all ethnic groups during 1996-2007, declines were greater for Pacific and Māori children and young people.

During the mid-late 1990s (using the Sole / Any classification), meningococcal disease admissions were higher for Tongan than for Samoan or Cook Island Māori children and young people. These differences decreased during the late-1990s and early 2000s, so that by 2006-07 rates were similar for all three Pacific groups. During 2003-2007, meningococcal disease admissions for Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of Tokelauan and Sole Fijian children and young people, where small numbers precluded a valid comparison). Within the Any Category, admissions were *significantly higher* for Tongan than for Cook Island Māori and Niue children and young people, although differences between groups in the Sole Category were less marked.

Local Policy Documents and Reviews Relevant to the Prevention of Meningococcal Disease

In New Zealand a range of policy documents and reviews are relevant to the primary prevention of meningococcal disease. These include:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 31 on Page 119
2. **Interventions Aimed at Smoking / Tobacco Control:** Table 32 on Page 120**.**
3. **Interventions Aimed at Housing and Household Crowding:** Table 33 on Page 121
4. **Interventions Aimed at Breastfeeding:** Breastfeeding Section on Page 58

In addition, a number of publications consider New Zealand's recent approaches to prevention, and in particular the roll out of the National Meningococcal B Immunisation Campaign. These publications are briefly summarised in **Table 68**.

Table 68. Local Policy Documents and Reviews Relevant to the Prevention of Meningococcal Disease

Ministry of Health Policy Documents
In New Zealand a range of policy documents are relevant to the prevention of meningococcal disease in children & young people (see links on previous page)
Ministry of Health. **The Meningococcal B Immunisation Programme: A Response to an Epidemic: National Implementation Strategy**. **Ko koe ki tënä kö au ki tënei kiwei ö te kete: Kia tühauora ki tua ö rangi. Working for a healthy future**. 2004, Wellington. This document contains background information on the meningococcal B epidemic, the rationale for developing the immunisation programme, an overview of the clinical trials, vaccine production and safety monitoring. A set of programme objectives, the planned roll out timeframes and schedules, guidelines for service delivery, and a discussion of vaccine supply, workforce requirements and communication models are also presented. While the meningococcal vaccine is no longer delivered routinely in New Zealand, the approach to such an epidemic may provide useful learning.
Systematic and Other Reviews from the International Literature
Bilukha O. Messonnier N. Fischer M. **Use of Meningococcal Vaccines in the United States.** Pediatric Infectious Disease Journal, 2007. 26(5):371-6. This review summarises the CDC Advisory Committee on Immunisation Practices and the American Academy of Pediatrics' recommendations for routine vaccination. They recommend vaccination with MCV4 (containing serogroups A, C, Y, W-135) for: (1) adolescents 11–12 years of age; and (2) adolescents who previously have not received MCV4, vaccination before high school entry (15-year-olds). They believe that recommending the use of MCV4 vaccination at 11–12 years of age may strengthen the role of the scheduled adolescent visit and have a positive effect on vaccine coverage in adolescence. Routine vaccination at high school entry should provide an additional opportunity to vaccinate adolescents entering the period of increased disease incidence in late adolescence and young adulthood.
Other Relevant Publications
Martin D, Lopez L. **The Epidemiology of Meningococcal Disease in New Zealand in 2007**. 2008, ESR; Wellington. http://www.MOH.govt.nz/MOH.nsf/pagesmh/8204/$File/meningo-annual-report-2007.pdf This document briefly summarises the history of the Meningococcal B epidemic in New Zealand and the steps that were taken to address this epidemic, including the development of a vaccine, and the roll out of the immunisation campaign which eventually curbed the epidemic.
Sexton K. Lennon D. Oster P, et al. **The New Zealand Meningococcal Vaccine Strategy: A Tailor-Made Vaccine to Combat a Devastating Epidemic**. New Zealand Medical Journal, 2004. 117(1200):U1015. This article reviews the development of the New Zealand Meningococcal Vaccine Strategy. It also outlines the National Prevention and control Plan for Meningococcal disease which includes increased epidemiological surveillance, promoting public awareness to facilitate early medical intervention, promoting professional awareness to encourage early diagnosis and treatment, prevention of secondary cases by notification, contact tracing and offering prophylactic antibiotics, a 3 year case control study to identify modifiable factors and a meningococcal vaccine strategy.

Tuberculosis

Introduction

Tuberculosis (TB) is caused by *Mycobacterium tuberculosis,* an organism transmitted by the inhalation or ingestion of infected droplets. The disease usually affects the lungs, although infection of multiple organ systems can occur. Initial infection often goes unnoticed, with most infected individuals entering a latent phase. Progression to active TB occurs in about 5-15% of cases, with the risk of progression being influenced by the size of the infecting dose and the immunity of the individual exposed [232]. Persons with immunodeficiency e.g. those with HIV, may progress to disseminated forms of the disease, involving multiple organs such as the liver, lungs, spleen, bone marrow and lymph nodes [202].

New Zealand's TB rates fell progressively during the first half of last century reaching a nadir of 295 cases in 1988 and thereafter remaining static at approximately 300-500 cases per year. Childhood TB has followed a similar pattern, although a clear resurgence in TB in children was evident during 1992-2001 [233]. In one recent review, New Zealand's childhood TB rates were highest for those <5 years of age, those living in the most deprived areas and those of African > Pacific Island > Māori > Asian > European ethnic origins. Most cases were identified by contact tracing or immigrant screening and the majority were thought to originate either as part of a local outbreak, or as a consequence of migration from high risk countries [233] (e.g. in one recent outbreak amongst a Pacific community in New Zealand, only 58% of (n=24) children subsequently diagnosed with TB had symptoms at diagnosis and only 20% (n=5) presented to medical attention for these symptoms [234]). Thus from a public health perspective, the mainstays of controlling TB infection remain case finding and the treatment of active and latent infections, contact tracing, the selective screening of high risk groups, and the vaccination (BCG) of high risk neonates [232].

The following section explores TB rates amongst Pacific children and young people in New Zealand using information from the National Minimum Dataset and Mortality Collection. The section concludes with a review of policy and evidence based review documents which consider interventions to address TB at the population level.

Data Source and Methods

Definition

Hospital Admissions and Deaths due to Tuberculosis in Children and Young People Aged 0-24 years

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions of children and young people (0-24 years) with a primary diagnosis of tuberculosis (ICD-9 010-018; ICD-10 A15-A19)
Deaths Numerator: National Mortality Collection: Deaths in children and young people (0-24 years) where the main underlying cause of death (clinical code) was tuberculosis (ICD-9 010-018; ICD-10 A15-A19)
Denominator: NZ Census

Notes on Interpretation

Note 1*: Appendix 4: The National Minimum Dataset* outlines the limitations of hospital admission data. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category

Admissions: Proxy B-C; Mortality: Ideal B

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during the late 1990s-early 2000s, hospital admissions for TB gradually increased. Rates reached a peak in 2002-2003, and since then have declined (**Figure 88**). In addition, during 1990-2005, three New Zealand children / young people died as a result of TB.

New Zealand Age Distribution

During 2003-2007, while there was a small peak amongst children <3 years of age, TB admissions were highest for young people in their late teens and early twenties (**Figure 89**).

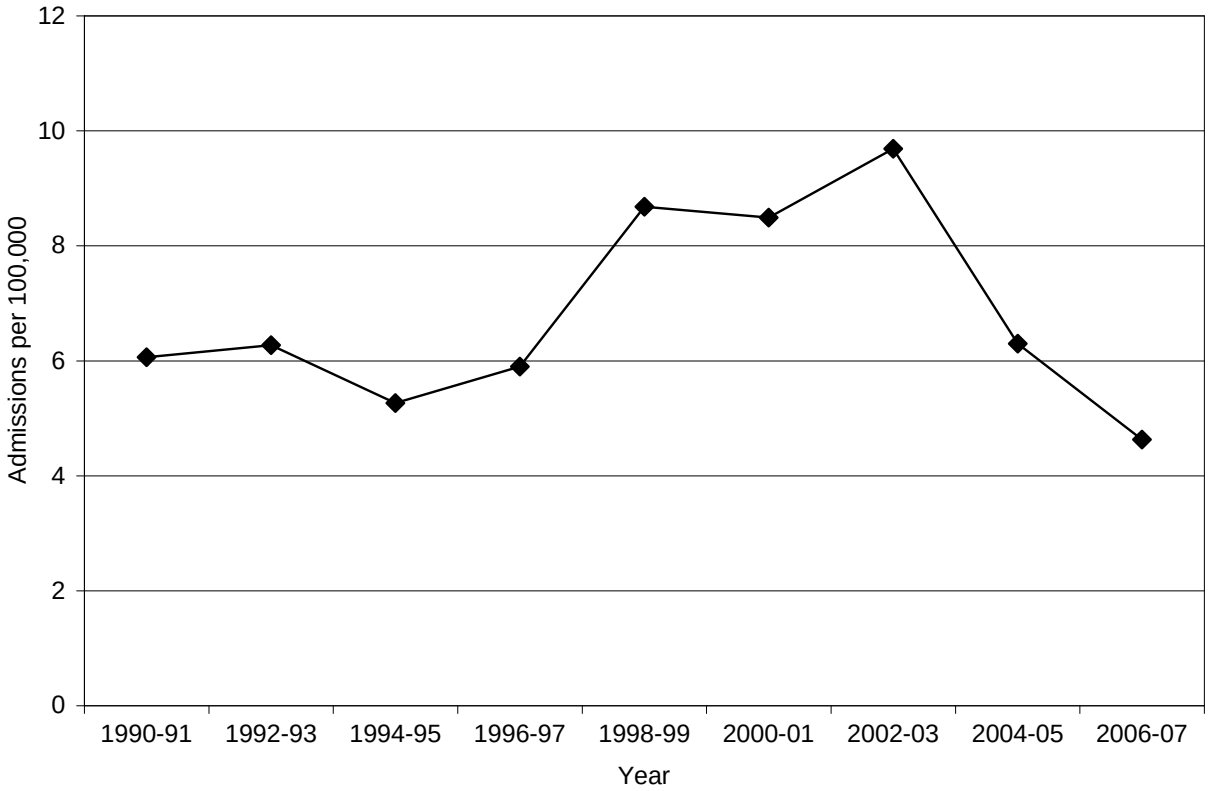
Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

During 2003-2007, hospital admissions for TB were *significantly* higher for Asian and Pacific > Māori > European children and young people and those living in urban or deprived areas (**Table 69**). During 1996-2007, while small numbers make precise interpretation of trends difficult, hospital admissions for TB remained higher for Pacific and Asian children and young people. Admissions were also higher for Sole than for Any Pacific children and young people during this period (**Figure 90**).

Distribution by Season

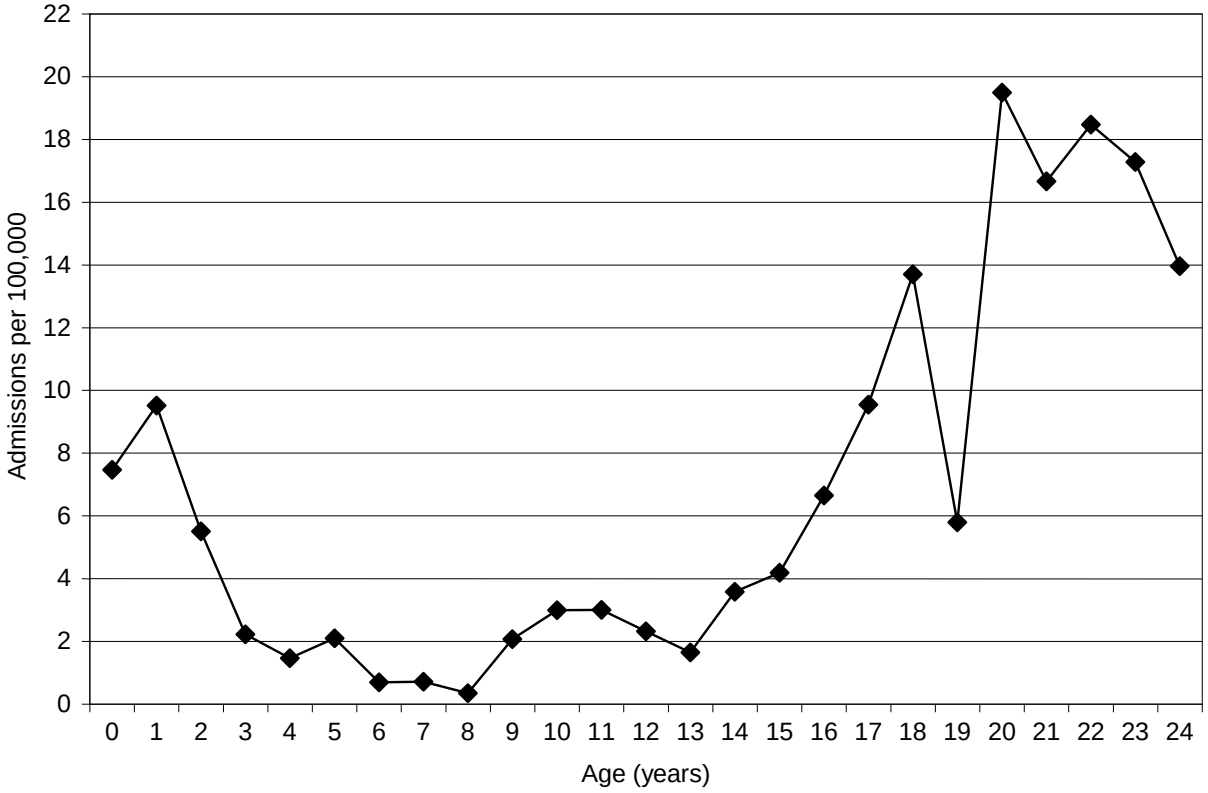
In New Zealand during 2003-2007, hospital admissions for TB were highest in late winter and spring, although small numbers (and the association of TB with outbreaks) mean that seasonal patterns should be interpreted with caution (**Figure 91**).

Figure 88. Hospital Admissions for Tuberculosis in Children and Young People 0-24 Years, New Zealand 1990-2007



Source: Numerators-National Minimum Dataset; Denominator-Census.

Figure 89. Hospital Admissions for Tuberculosis in Children and Young People 0-24 Years by Age, New Zealand 2003-2007



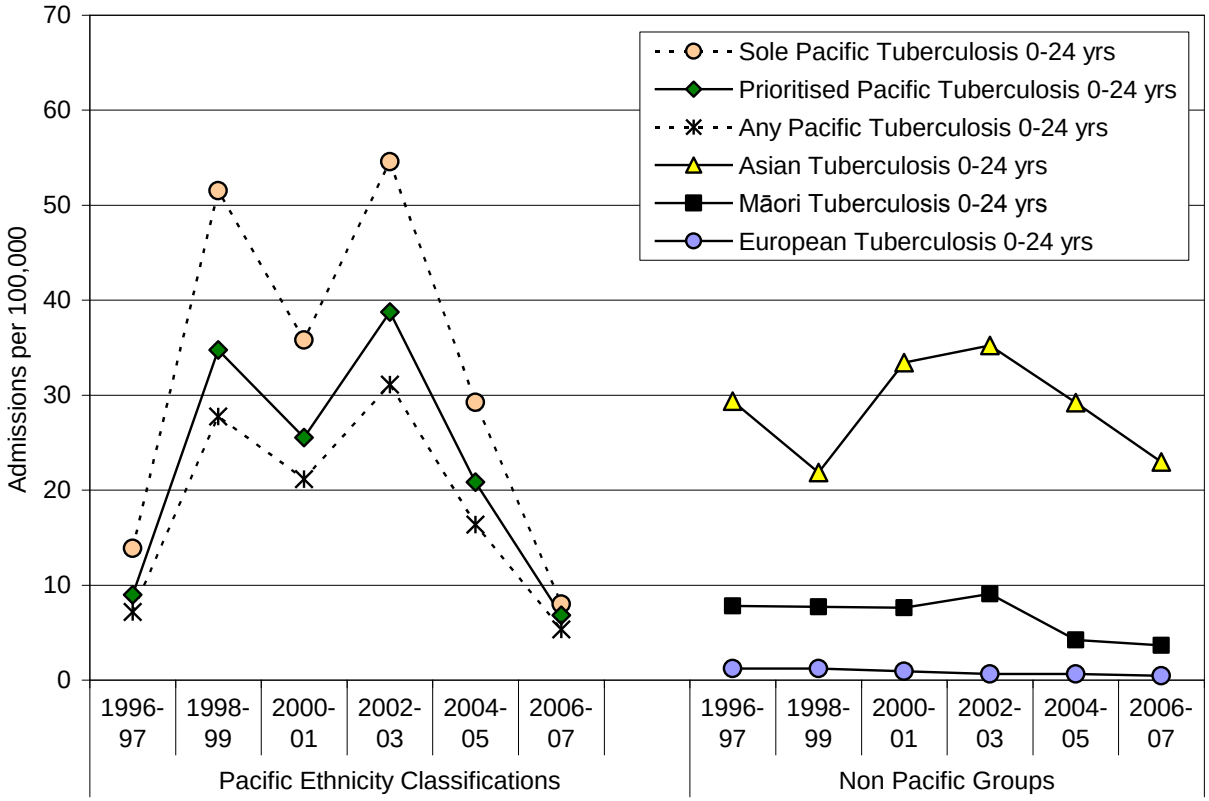
Source: Numerators-National Minimum Dataset; Denominator-Census.

Table 69. Risk Factors for Hospital Admissions due to Tuberculosis in Children and Young People 0-24 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Quintile				Prioritised Ethnicity			
1-2	2.75	1.00		European	0.57	1.00	
3-4	3.03	1.10	0.70 - 1.72	Māori	5.16	8.98	5.63 - 14.30
5-6	6.32	2.30	1.56 - 3.38	Pacific	21.23	36.94	23.65 - 57.70
7-8	6.57	2.39	1.63 - 3.50	Asian	28.87	50.23	32.62 - 77.37
9-10	12.76	4.64	3.27 - 6.57	Urban / Rural			
Gender				Urban	7.27	1.00	
Female	7.07	1.00		Rural	2.71	0.37	0.25 - 0.55
Male	6.28	0.89	0.74 - 1.06				

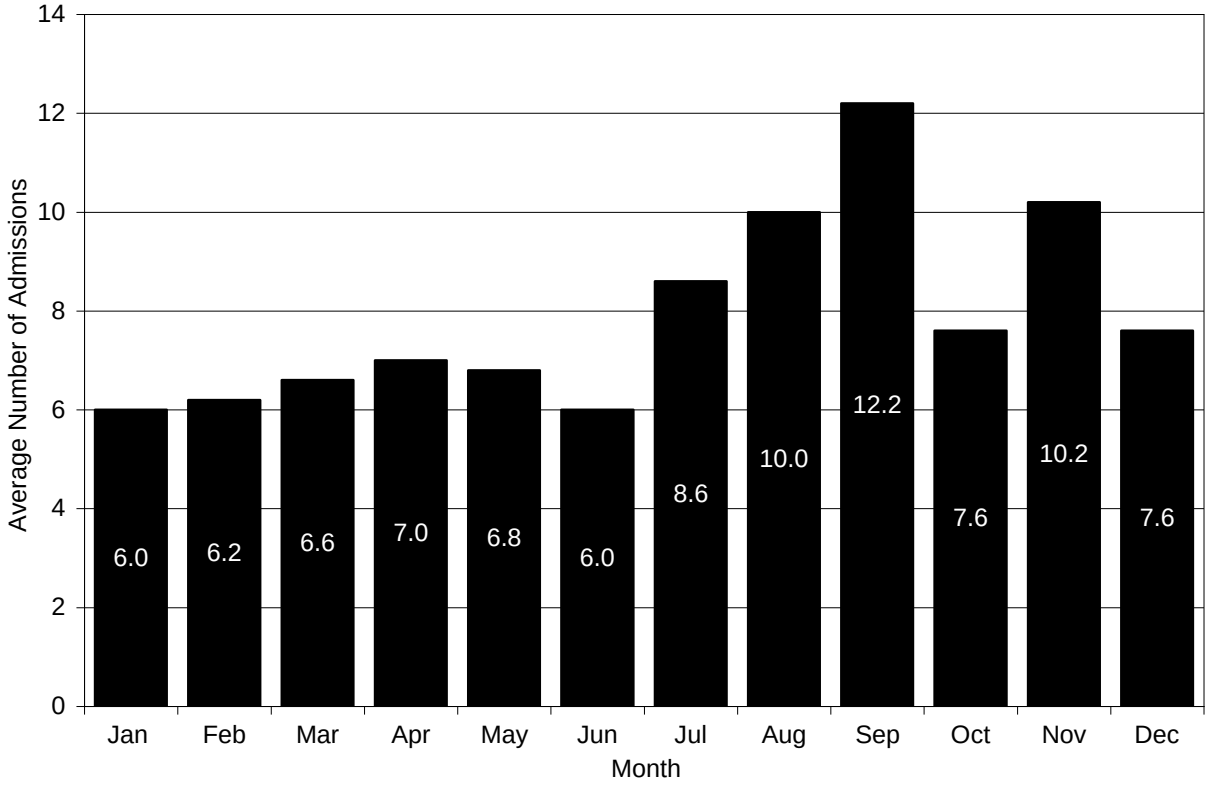
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Figure 90. Hospital Admissions for Tuberculosis in Children and Young People 0-24 Years by Ethnicity, New Zealand 1996-2007



Source: Numerators-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 91 Average Number of Hospital Admissions for Tuberculosis per Month in Children and Young People 0-24 Years, New Zealand 2003-2007



Source: National Minimum Dataset

TB Admissions Amongst Pacific Groups in New Zealand

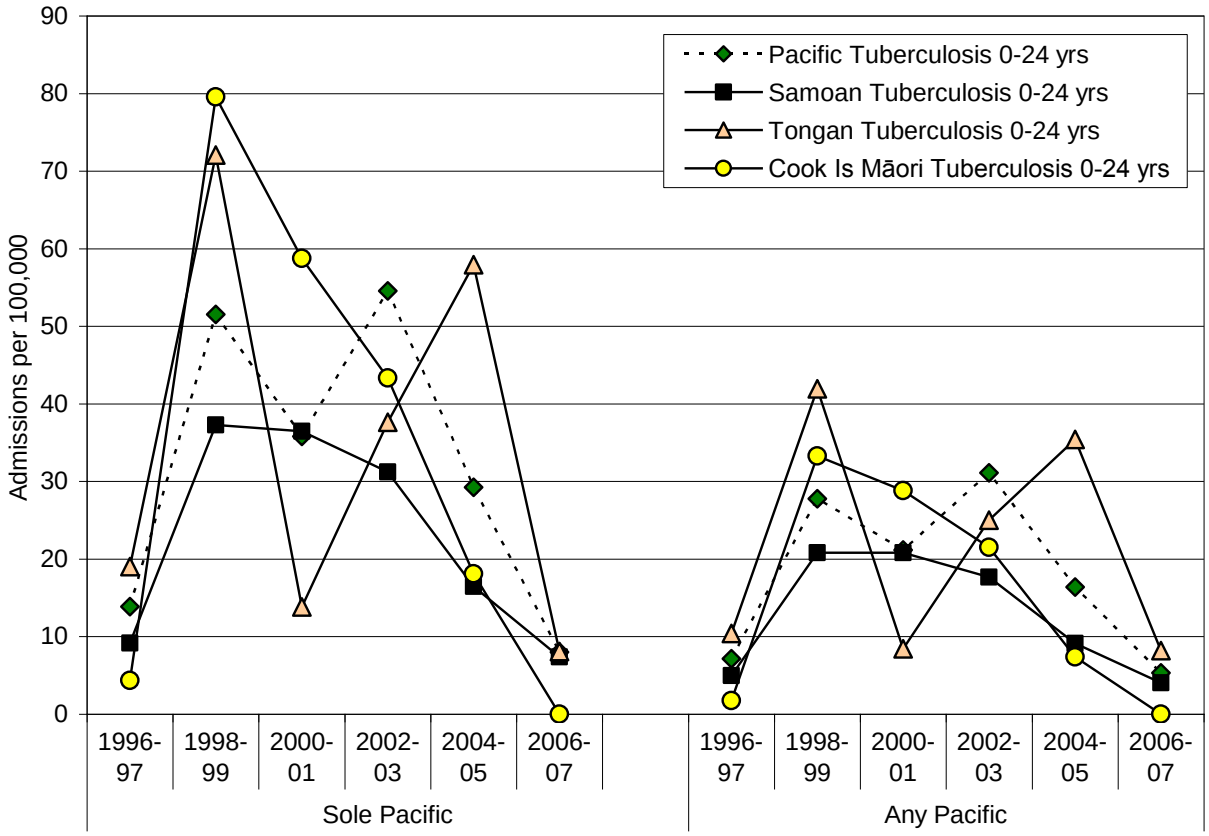
Pacific Group Trends

During 1996-2007 (using the Sole / Any classification), there were no consistent differences in TB admissions between Samoan, Tongan or Cook Island Māori children and young people (**Figure 92**).

Distribution by Pacific Group

During 2003-2007 (using the Sole / Any classification), TB admissions for Sole and Any Samoan, Tongan, Cook Island Māori and Other Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people (small numbers prevented valid comparisons for Niuean, Fijian and Tokelauan children and young people). Within both the Any and Sole Categories, admissions for "Other" Pacific children and young people were *significantly higher* than for Samoan and Cook Island Māori and Tongan children and young people. (Note: Rate ratios for Pacific children and young people, when compared to the non-Māori non-Pacific group, are lower than when compared to the European group, due to the higher TB admission rates in Asian / Indian children and young people (**Table 70**)).

Figure 92. Hospital Admissions for Tuberculosis in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 1996-2007



Source: Numerators-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Table 70. Distribution of Hospital Admissions due to Tuberculosis in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Any Samoan	35	7.0	9.72	1.78	1.25-2.53
Any Tongan	37	7.4	25.68	4.70	3.33-6.62
Any Cook Island Māori	16	3.2	9.37	1.71	1.04-2.84
Any Niuean	<5	s	s	s	s
Any Fijian	<5	s	s	s	s
Any Tokelauan	<5	s	s	s	s
Any Other Pacific	23	4.6	103.48	18.91	12.36-28.94
Any Pacific	121	24.2	16.66	3.05	2.46-3.77
Any Māori	77	15.4	5.16	0.94	0.73-1.21
Non-Māori Non-Pacific	276	55.2	5.47	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Sole Samoan	35	7.0	17.59	3.21	2.26-4.57
Sole Tongan	34	6.8	38.65	7.06	4.95-10.09
Sole Cook Island Māori	15	3.0	21.73	3.97	2.36-6.68
Sole Niuean	<5	s	s	s	s
Sole Fijian	<5	s	s	s	s
Sole Tokelauan	<5	s	s	s	s
Sole Other Pacific	22	4.4	222.70	40.71	26.38-62.81
Sole Pacific	116	23.2	29.23	5.34	4.30-6.64
Sole Māori	72	14.4	10.65	1.95	1.50-2.52
Non-Māori Non-Pacific	276	55.2	5.47	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted; s: Rate not calculated due to small numbers.

Summary

In New Zealand during the late 1990s-early 2000s, hospital admissions for TB gradually increased. Rates reached a peak in 2002-2003, and since then have declined. In addition, during 1990-2005, three New Zealand children / young people died as a result of TB. During 2003-2007, while there was a small peak in children <3 years, TB admissions were highest for young people in their late teens and early twenties. TB admissions were also *significantly* higher for Asian and Pacific > Māori > European children and young people and those living in urban or deprived areas.

During 2003-2007 (using the Sole / Any classification), TB admissions for Sole and Any Samoan, Tongan, Cook Island Māori and Other Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people (small numbers prevented valid comparisons for Niuean, Fijian and Tokelauan children and young people). Within both the Any and Sole Categories, admissions for “Other” Pacific children and young people were *significantly higher* than for Samoan and Cook Island Māori and Tongan children and young people.

Local Policy Documents and Evidence Based Reviews Relevant to the Prevention and Control of Tuberculosis

In New Zealand a range of policy documents are relevant to the primary prevention of TB. These include:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 31 on Page 119
2. **Interventions Aimed at Smoking / Tobacco Control:** Table 32 on Page 120.
3. **Interventions Aimed at Housing and Household Crowding:** Table 33 on Page 121

In addition, a range of local policy documents and overseas reviews consider the most effective methods for the control of TB. These are briefly listed in **Table 71**.

Table 71. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention and Control of Tuberculosis

Ministry of Health Policy Documents
In New Zealand a range of policy documents are relevant to the primary prevention of tuberculosis in children and young people (see links on previous page)
Ministry of Health. **Review of Neonatal BCG Immunisation Services in New Zealand.** 2007, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/indexmh/review-of-neonatal-bcg-immunisation-services This document reviews New Zealand's current BCG immunisation programme. It highlights a number of issues with current programme delivery particularly around the quality of data collection. It also makes a number of recommendations about contracts, monitoring, resources needed and surveillance.
Ministry of Health. **Guidelines for Tuberculosis Control in New Zealand 2003**. 2002, Wellington: Ministry of Health. This comprehensive document provides information on many aspects of TB control. Chapter 11 focuses on the role of health promotion and health education and suggests there is scope for further health promotion programmes for TB prevention/control. A number of recommendations are made as to how to achieve this.
Ministry of Health, **Communicable Disease Control Manual**. Public Health Group, Editor. 1998, Ministry of Health. This manual was developed to provide information on the prevention and control of communicable diseases in New Zealand and includes a section on TB (Note: the manual is currently being reviewed and a new edition is expected in the near future).
Systematic and Other Reviews from the International Literature
Teo S, Shingadia D. **Does BCG Have A Role In Tuberculosis Control And Prevention In The United Kingdom?** Archives of Disease in Childhood, 2006. 91(6):529-31. This article reviews current UK guidelines for BCG vaccination. The authors argue that the new policy aims to identify and vaccinate those at highest risk of TB but does not address difficulties in implementation. It also emphasises that there must be mechanisms whereby changing local and overseas epidemiological data can be efficiently translated into effective public policy. Other concerns raised include the lack of clarity around how high risk infants are identified and that, in the absence of a school BCG programme, opportunistic screening and ''targeted vaccination'' of high risk children may not occur. Furthermore, the authors argue that better documentation of BCG vaccination, allowing more effective monitoring of this programme, is needed. The authors note the need for other components of TB control, particularly early diagnosis and treatment of infectious individuals, and improved surveillance, contact tracing, and new entrant screening.
The National Collaborating Centre for Chronic Diseases. **Tuberculosis: Clinical Diagnosis and Management of Tuberculosis, and Measures for its Prevention and Control**. 2006, Royal College of Physicians; London. http://www.nice.org.uk/nicemedia/pdf/CG033FullGuideline.pdf This guideline was commissioned by National Institute for Clinical Excellence, specifically for use in the United Kingdom. Chapters 11-14 focus on prevention and control of TB.

Binkin N, Vernon A, Simone P, et al. **Tuberculosis Prevention and Control Activities in The United States: An Overview of the Organization Of Tuberculosis Services.** International Journal of Tuberculosis & Lung Disease, 1999. 3(8):663-74.

This paper reviews current TB epidemiology in the US, and presents a brief history of TB control efforts. The current organisational structure of TB services, the role of the private sector in TB control, TB control funding, and the mechanisms by which TB policy is developed are described. The US model combines a centralised role for national government in the development of policy, funding, and in maintaining national surveillance, with a decentralised role for state and local jurisdictions, which adapt and implement national guidelines and are responsible for day-to-day programme activities. Given the relative success of this combined approach, the authors suggest that other countries facing the challenge of maintaining an effective TB control programme in the face of increased decentralisation of health services, may find this description useful.

Other Relevant Publications

The Asthma and Respiratory Foundation of New Zealand. **Trying to Catch Our Breath: The Burden of Preventable Breathing Diseases in Children and Young People**, 2006. I. Asher and C. Byrnes, Editors. 2006: Wellington.

This review of the burden of respiratory disease in New Zealand children contains a section which focuses on TB (pg 47-50). Recommendations for TB control in New Zealand include continued commitment to treatment/surveillance programmes, cooperation with other agencies to improve screening and reduce the spread of disease, and development of community based education programmes for at risk groups.

Å Rheumatic Fever

Introduction

Acute rheumatic fever is a delayed inflammatory reaction which develops in response to a group A streptococcal throat infection. It usually occurs in school-age children and may affect the brain, heart, joints, skin or subcutaneous tissue [202]. Recurrent episodes of rheumatic fever may result in the development of rheumatic heart disease, a progressive condition leading to damage, scarring and deformities of the heart valves and chordae tendineae [202].

In New Zealand, a recent review of acute rheumatic fever (ARF) hospitalisations during 1995-2005 suggested that while rates for European children had declined, rates for Māori and Pacific children had increased. During this period, ARF was concentrated in the Upper North Island, with rates for Pacific children being 20.7 times higher than for European children [235]. Known risk factors for acute rheumatic fever include age (school age children), ethnicity (Pacific > Māori > European), socioeconomic disadvantage and overcrowding [236]. Primary prevention focuses on the adequate treatment of streptococcal throat infections, while secondary prevention aims to ensure that those previously diagnosed with rheumatic fever receive monthly antibiotic prophylaxis, either for 10 years from their first diagnosis or until 21 years of age, to prevent sequelae [236].

The following section explores rheumatic fever and heart disease rates in Pacific children and young people in New Zealand using information from the National Minimum Dataset and Mortality Collection. The section concludes with a review of policy and evidence based review documents which consider interventions to address rheumatic fever and heart disease at the population level.

Data Source and Methods

Definition

Hospital Admissions and Deaths due to Acute Rheumatic Fever and Rheumatic Heart Disease in Children and Young People Aged 0-24 Years

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions of children and young people (0-24 years) with a primary diagnosis of either Acute Rheumatic Fever (ICD-9 390-392; ICD-10 I00-I02) or Rheumatic Heart Disease (ICD-9 393-398: ICD-10 I05-I09)

Deaths Numerator: National Mortality Collection: Deaths in children and young people (0-24 years) where the main underlying cause of death (clinical code) was either acute rheumatic fever (ICD-9 390-392; ICD-10 I00-I02) or rheumatic heart disease (ICD-9 393-398: ICD-10 I05-I09)

Denominator: NZ Census

Notes on Interpretation

Note 1*: Appendix 4: The National Minimum Dataset* outlines the limitations of hospital admission data. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category

Admissions: Proxy B; Mortality: Ideal B

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1996-2007, hospital admissions for rheumatic fever and heart disease remained relatively static, while deaths averaged 1-2 cases per year during 1998-2005 (**Figure 93**).

New Zealand Age Distribution

During 2003-2007, hospital admissions for acute rheumatic fever were highest for those aged 7-15 years, while admissions for rheumatic heart disease were relatively constant (albeit at a much lower rate) after 6 years of age (**Figure 94**).

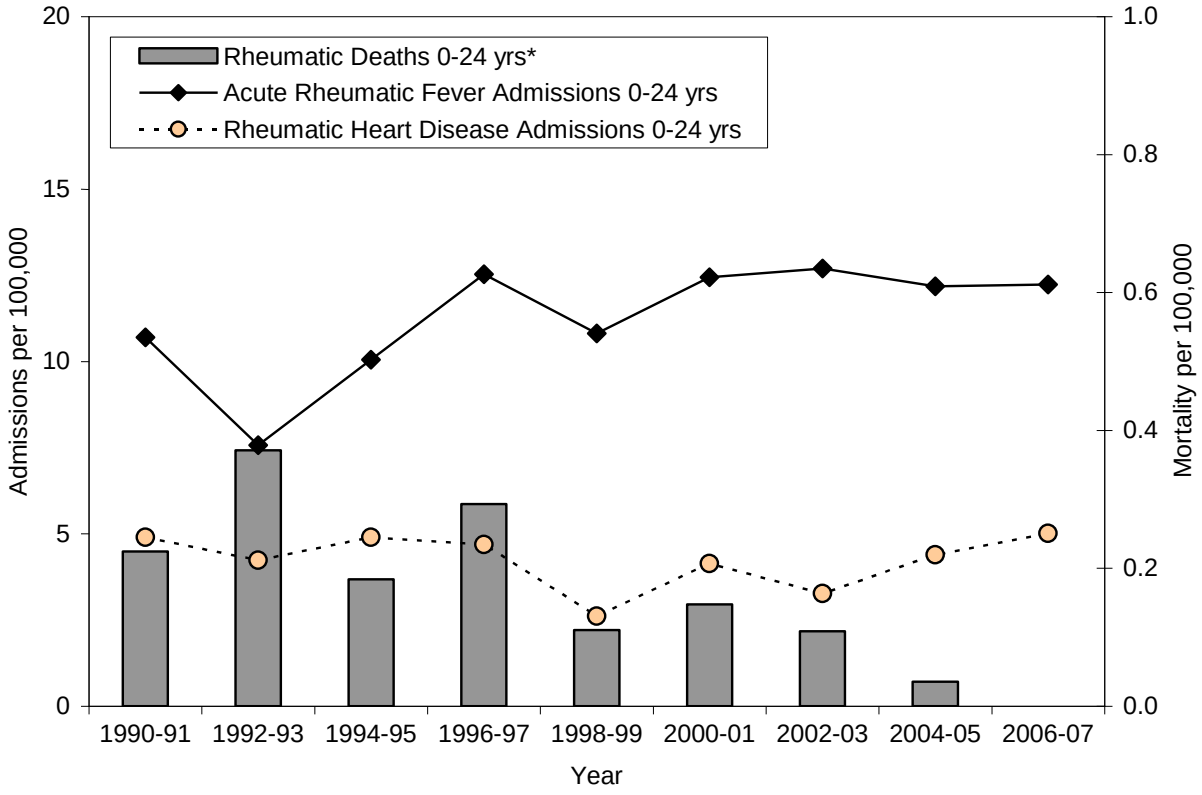
Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Distribution

During 2003-2007, hospital admissions for acute rheumatic fever were *significantly higher* for Pacific > Māori > European and Asian children and young people, males and those living in urban or deprived areas (**Table 72**). During 1996-2007, while small numbers make precise interpretation of trends difficult, admissions for both acute rheumatic fever and rheumatic heart disease remained higher for Pacific > Māori > European and Asian children and young people. Rates were also higher for Sole than for Any Pacific children and young people during this period (**Figure 95**, **Figure 96**).

Distribution by Season

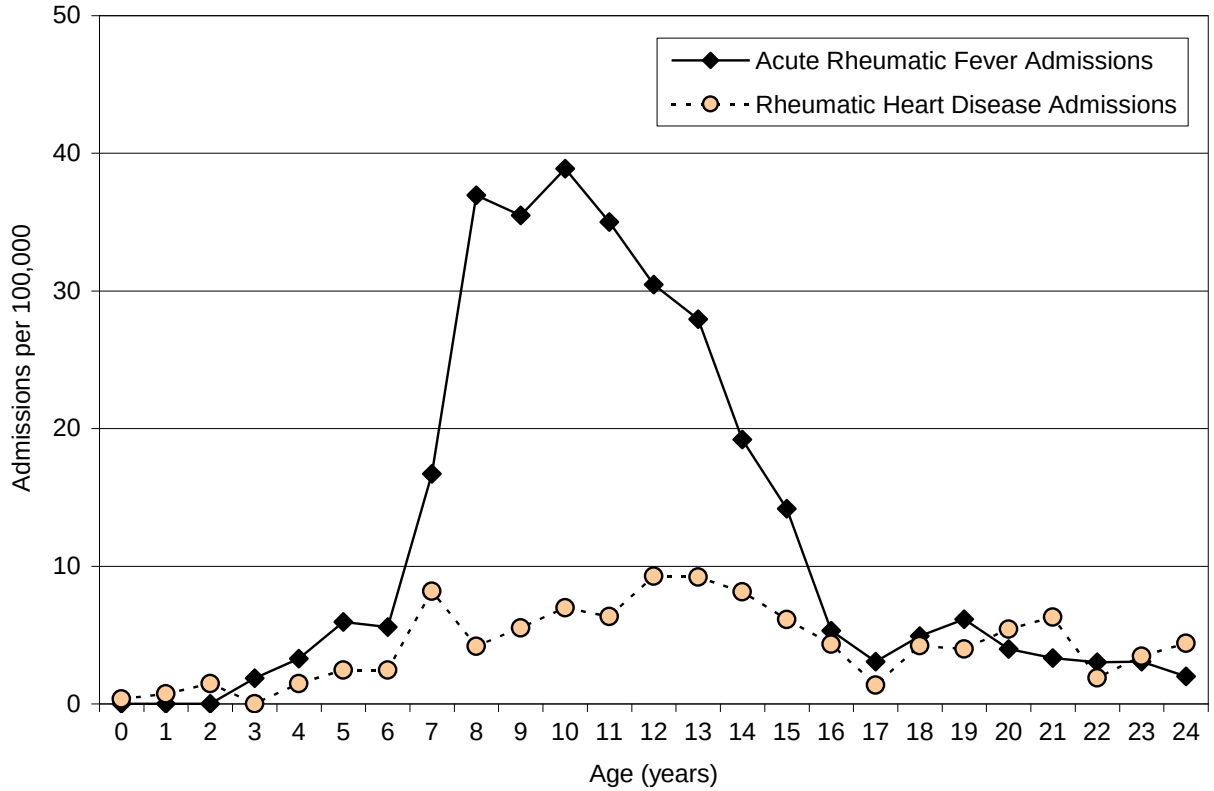
In New Zealand during 2003-2007, while small numbers make precise interpretation difficult, hospital admissions for acute rheumatic fever were generally higher in the colder months (**Figure 97**).

Figure 93. Hospital Admissions (1990-2007) and Deaths (1990-2005) from Acute Rheumatic Fever and Rheumatic Heart Disease in New Zealand Children and Young People 0-24 Years



Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census. Note: *Rheumatic Deaths include Acute Rheumatic Fever and Rheumatic Heart Disease deaths; Mortality data unavailable for 2006-07.

Figure 94. Hospital Admissions for Acute Rheumatic Fever and Rheumatic Heart Disease in Children and Young People 0-24 Years by Age, New Zealand 2003-2007



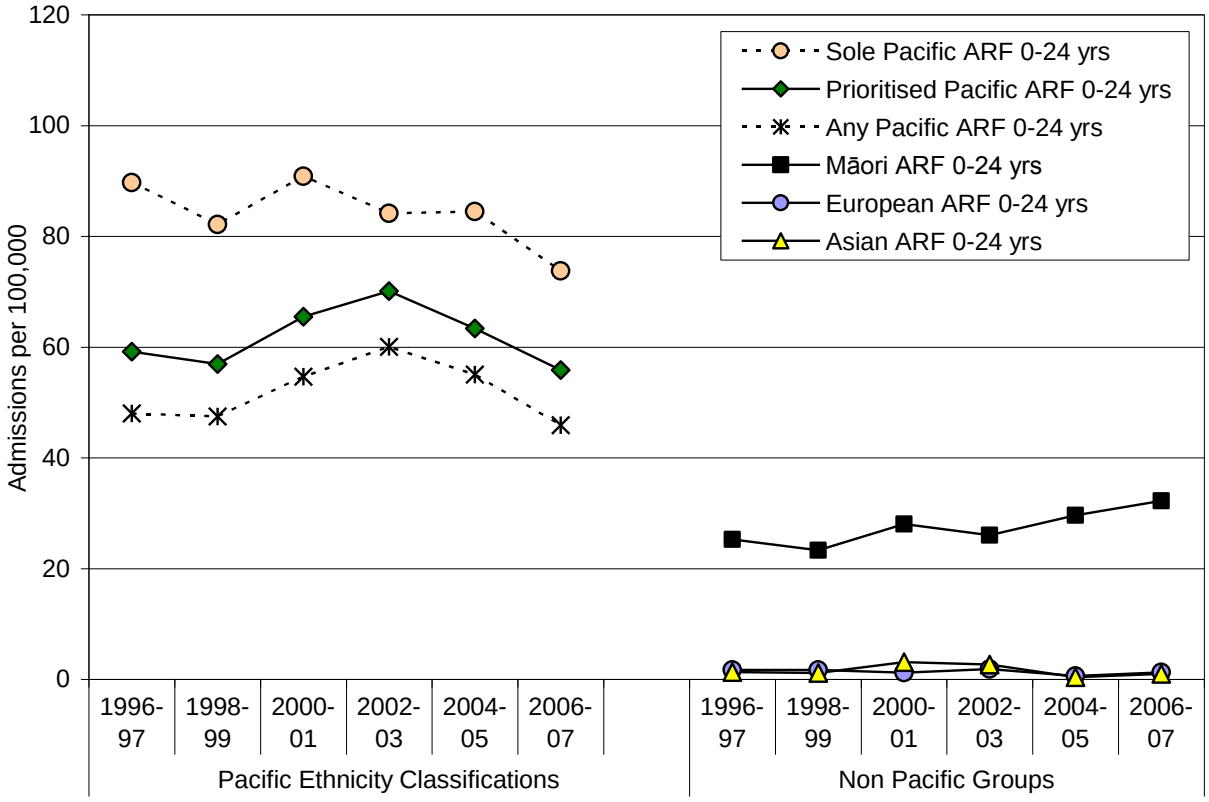
Source: Numerator-National Minimum Dataset; Denominator Census.

Table 72. Risk Factors for Hospital Admission due to Acute Rheumatic Fever in Children and Young People 0-24 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Quintile				Prioritised Ethnicity			
1-2	1.26	1.00		European	1.15	1.00	
3-4	2.88	2.28	1.28 - 4.03	Māori	31.81	27.68	20.45 - 37.47
5-6	5.57	4.41	2.60 - 7.47	Pacific	61.76	53.74	39.52 - 73.07
7-8	9.50	7.52	4.54 - 12.46	Asian	0.88	0.77	0.33 - 1.79
9-10	37.04	29.32	18.11 - 47.46	Urban / Rural			
Gender				Urban	13.34	1.00	
Female	10.08	1.00		Rural	8.43	0.63	0.50 - 0.79
Male	15.22	1.51	1.32 - 1.73				

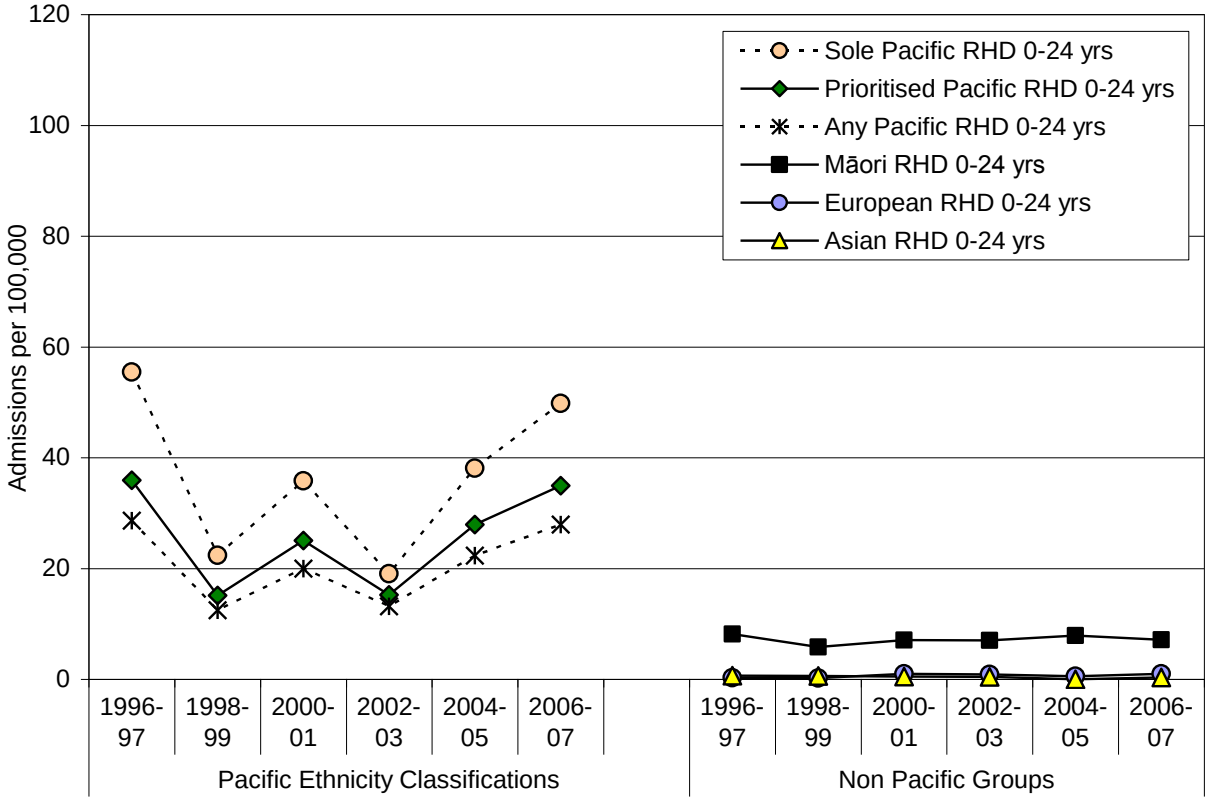
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted

Figure 95. Hospital Admissions for Acute Rheumatic Fever in Children and Young People 0-24 Years by Ethnicity, New Zealand 1996-2007



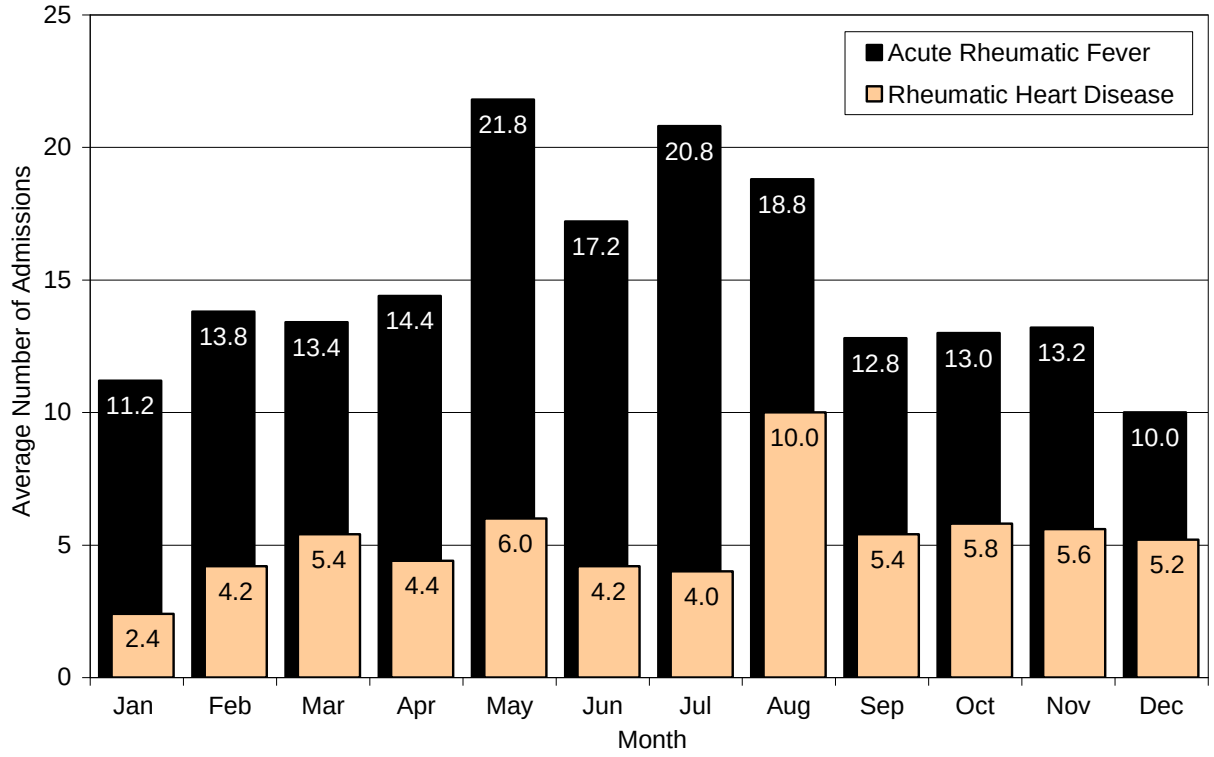
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details); ARF: Acute Rheumatic Fever.

Figure 96. Hospital Admissions for Rheumatic Heart Disease in Children and Young People 0-24 Years by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details); RHD: Rheumatic Heart Disease.

Figure 97. Average Number of Hospital Admissions for Acute Rheumatic Fever and Heart Disease in Children and Young People 0-24 Years by Month, New Zealand 2003-2007



Source: National Minimum Dataset

Acute Rheumatic Fever and Rheumatic Heart Disease Admissions Amongst Pacific Groups in New Zealand

Pacific Group Trends

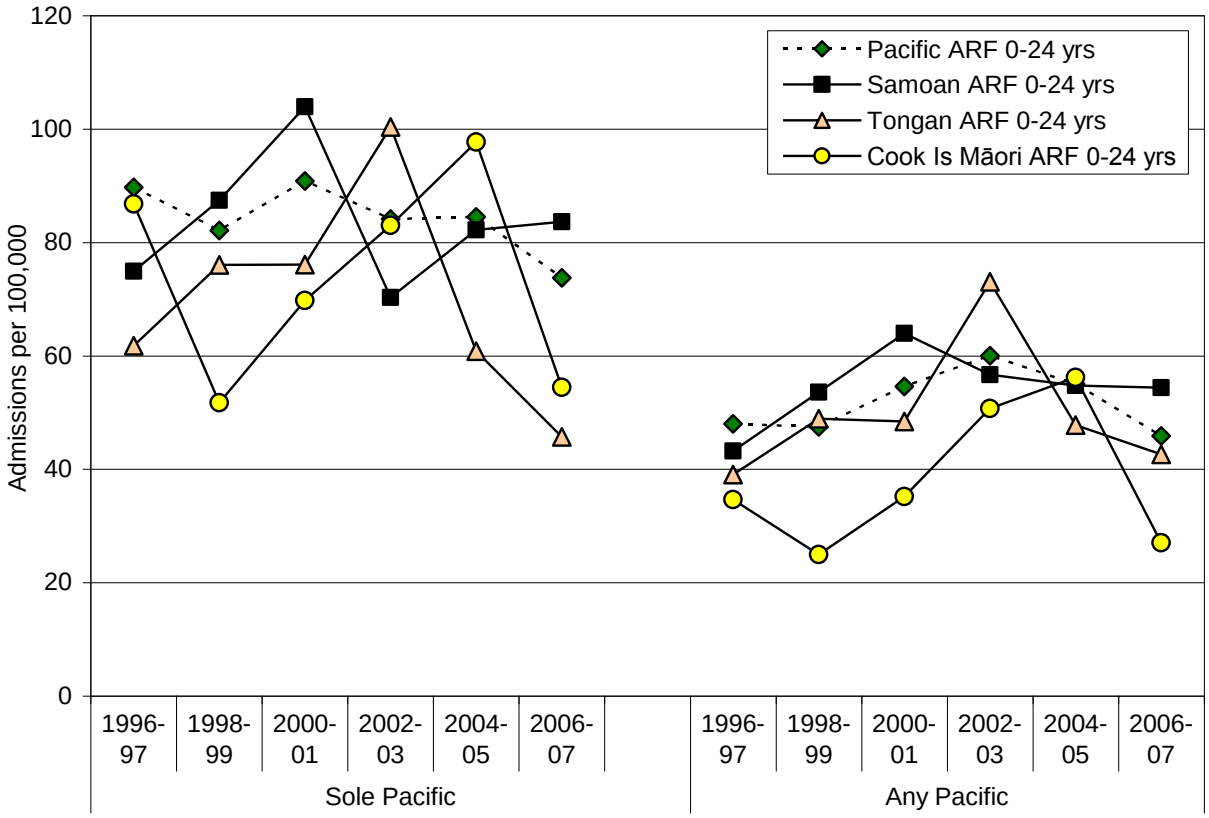
During 1996-2007 (using the Sole / Any classification), there were no consistent differences in admission rates for acute rheumatic fever or rheumatic heart disease between Samoan, Tongan or Cook Island Māori children and young people in either the Sole or Any categories (**Figure 98**, **Figure 99**).

Distribution by Pacific Group

During 2003-2007 (using the Sole / Any classification), acute rheumatic fever admissions for Pacific children and young people were significantly higher than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of Fijian children and young people where small numbers prevented a valid analysis). While admissions were highest for Tokelauan children and young people, the majority of differences between individual Pacific groups did not reach statistical significance (**Table 73**).

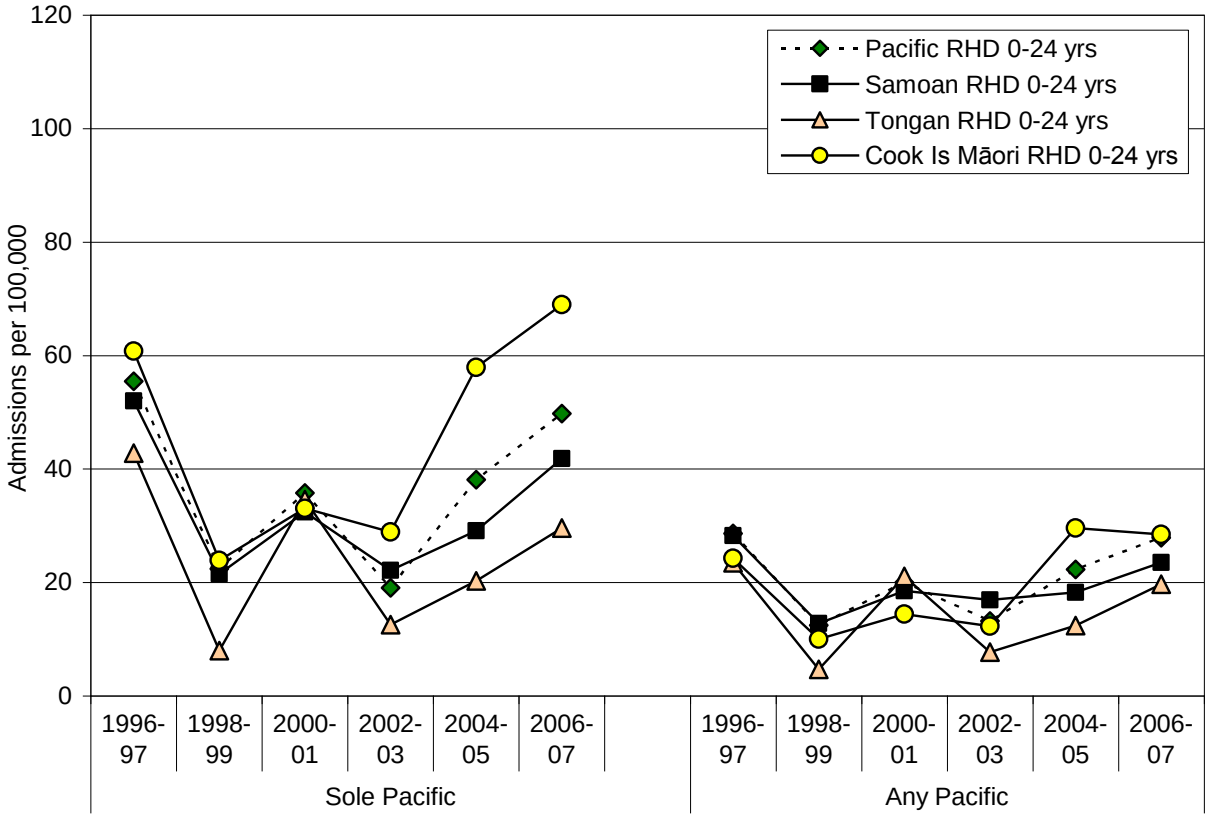
Similarly during 2003-2007, rheumatic heart disease admissions for Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of Tokelauan children and young people where small numbers prevented a valid comparison). While admissions were *significantly higher* for "Other" Pacific children and young people than for most other Pacific groups, small numbers meant that many other differences between individual Pacific groups did not reach statistical significance (**Table 73**).

Figure 98. Hospital Admissions for Acute Rheumatic Fever in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); ARF: Acute Rheumatic Fever.

Figure 99. Hospital Admissions for Rheumatic Heart Disease in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); ARF: Rheumatic Heart Disease.

Table 73. Distribution of Hospital Admissions for Acute Rheumatic Fever and Rheumatic Heart Disease in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 2003-2007

Any Pacific										
Pacific Group	Acute Rheumatic Fever					Rheumatic Heart Disease				
	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Any Samoan	202	40.4	56.10	37.74	28.95-49.19	71	14.2	19.72	23.13	15.84-33.79
Any Tongan	73	14.6	50.67	34.09	24.70-47.04	19	3.8	13.19	15.47	9.02-26.55
Any Cook Island Māori	75	15.0	43.93	29.55	21.46-40.69	45	9.0	26.36	30.92	20.36-46.97
Any Niuean	18	3.6	27.74	18.66	11.16-31.21	5	1.0	7.71	9.04	3.58-22.82
Any Fijian	<5	s	s	s	s	7	1.4	29.28	34.35	15.45-76.35
Any Tokelauan	19	3.8	93.55	62.93	38.04-104.08	<5	s	s	s	s
Any Other Pacific	19	3.8	85.48	57.50	34.76-95.11	18	3.6	80.98	95.01	54.81-164.69
Any Pacific	380	76.0	52.31	35.19	27.47-45.08	163	32.6	22.44	26.33	18.81-36.84
Any Māori	475	95.0	31.81	21.40	16.77-27.30	110	22.0	7.37	8.64	6.08-12.30
Non-Māori Non-Pacific	75	15.0	1.49	1.00		43	8.6	0.85	1.00	
Sole Pacific										
Pacific Group	Acute Rheumatic Fever					Rheumatic Heart Disease				
	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Sole Samoan	163	32.6	81.90	55.09	41.91-72.41	66	13.2	33.16	38.91	26.50-57.13
Sole Tongan	53	10.6	60.24	40.52	28.51-57.60	18	3.6	20.46	24.00	13.85-41.61
Sole Cook Island Māori	54	10.8	78.24	52.63	37.10-74.66	40	8.0	57.95	67.99	44.21-104.57
Sole Niuean	16	3.2	99.45	66.89	39.00-114.73	5	1.0	31.08	36.46	14.44-92.04
Sole Fijian	<5	s	s	s	s	7	1.4	82.60	96.90	43.61-215.35
Sole Tokelauan	10	2.0	157.46	105.91	54.78-204.79	<5	s	s	s	s
Sole Other Pacific	15	3.0	151.84	102.13	58.69-177.74	18	3.6	182.21	213.77	123.35-370.47
Sole Pacific	317	63.4	79.87	53.72	41.77-69.10	155	31.0	39.05	45.82	32.68-64.23
Sole Māori	415	83.0	61.37	41.28	32.28-52.79	93	18.6	13.75	16.14	11.24-23.16
Non-Māori Non-Pacific	75	15.0	1.49	1.00		43	8.6	0.85	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted; s: Rate not calculated due to small numbers.

Summary

During 1996-2007, New Zealand's hospital admissions rates for rheumatic fever and rheumatic heart disease remained relatively static, while deaths averaged 1-2 cases per year during 1998-2005. During 2003-2007, acute rheumatic fever admissions were highest for those aged 7-15 years, while rheumatic heart disease admissions were relatively constant (albeit at a much lower rate) after 6 years of age. Acute rheumatic fever admissions were also *significantly higher* for Pacific > Māori > European and Asian children and young people, males and those in urban or deprived areas.

During 2003-2007 (using the Sole / Any classification), acute rheumatic fever admissions for Pacific children and young people were significantly higher than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of the Fijian groups where small numbers prevented a valid analysis). While admissions were highest for Tokelauan children and young people, the majority of differences between Pacific groups did not reach statistical significance.

Similarly during 2003-2007, rheumatic heart disease admissions for Pacific children and young people were *significantly higher* than for non-Māori non-Pacific children and young people in each of the Sole and Any Groups (with the exception of the Tokelauan groups where small numbers prevented a valid comparison). While admissions were *significantly higher* for "Other" Pacific children and young people than for most other Pacific groups, small numbers meant that many other differences between Pacific groups did not reach statistical significance.

Local Guidelines and Evidence Based Reviews Relevant to the Prevention of Rheumatic Fever

The primary prevention of rheumatic fever focuses on the adequate treatment of streptococcal throat infections, while secondary prevention aims to ensure that children and young people previously diagnosed with rheumatic fever receive monthly antibiotic prophylaxis. In New Zealand, while there are no Government policy documents which focus solely on rheumatic fever, the National Heart Foundation has developed a set of guidelines on the prevention and management of rheumatic fever. These are reviewed in **Table 74**.

In addition, many of the measures previously reviewed in the context of respiratory and infectious diseases generally, are likely to have a significant impact on rheumatic fever rates:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 31 on Page 119
2. **Interventions Aimed at Smoking / Tobacco Control:** Table 32 on Page 120.
3. **Interventions Aimed at Housing and Household Crowding:** Table 33 on Page 121
4. **Strategies to Improve Access to Primary Care:** Table 28 on Page 108

Table 74. Local Guidelines and Evidence Based Reviews Relevant to the Prevention of Rheumatic Fever and Heart Disease

Ministry of Health Policy Documents
In New Zealand while no Government policy documents focus solely on the prevention of rheumatic fever, a range of documents consider the prevention of infectious diseases more generally (see links on previous page)
Systematic and Other Reviews from the International Literature
The National Heart Foundation of New Zealand. **New Zealand Guidelines for Rheumatic Fever 1. Diagnosis, Management and Secondary Prevention. Evidence-Based, Best Practice Guidelines**. 2006, Auckland, National Heart Foundation of New Zealand. This guideline aims to improve consistency in the approach to rheumatic fever, and reduce mortality and morbidity from acute rheumatic fever and rheumatic heart disease. It includes a number of recommendations for the prevention of rheumatic fever including contact tracing of susceptible contacts. (Note: This Guideline is also briefly summarised in: Atatoa-Carr P. Lennon D. Wilson N. New Zealand Rheumatic Fever Guidelines Writing Group. Rheumatic Fever Diagnosis, Management, and Secondary Prevention: A New Zealand Guideline. New Zealand Medical Journal, 2008. 121(1271):59-69.)
The National Heart Foundation of New Zealand and Cardiac Society of Australia and New Zealand. **New Zealand Guidelines for Rheumatic Fever 2. Group A Streptococcal Sore Throat Management. Evidence-based, best practice Guidelines.** 2007, The National Heart Foundation of New Zealand: Auckland. This guideline focuses on preventing acute rheumatic fever by ensuring Group A Streptococcal throat infections are identified and treated appropriately. The guideline outlines an algorithm for the management of sore throats, which is based on a number of known risk factors as well as a range of clinical criteria.
Robertson K, Volmink J, Mayosi B. **Antibiotics for The Primary Prevention of Acute Rheumatic Fever: A Meta-Analysis.** BMC Cardiovascular Disorders, 2005. 5:11. This systematic review found that antibiotic treatment of sore throat with accompanying symptoms suggestive of group A streptococcal (GAS) infection is effective in reducing the attack rate of acute rheumatic fever by 70%. Intramuscular penicillin appears to reduce the attack rate by as much as 80%. There was one fewer case of acute rheumatic fever for every 50–60 patients treated with antibiotics. These findings suggest that antibiotic treatment can be effective for preventing acute rheumatic fever in a population with suspected GAS throat infection.
Forthcoming Publications
The National Heart Foundation of New Zealand, Cardiac Society of Australia and New Zealand. **Evidence-Based, Best Practice New Zealand Guidelines for Rheumatic Fever: 3. Proposed Rheumatic Fever Primary Prevention Programme** [Draft: December 2007], Auckland. This document contains a meta-analysis of school based Group A Streptococcus (GAS) sore throat interventions and suggests that school-based GAS sore throat interventions are effective in reducing the incidence of acute rheumatic fever (ARF). Studies meeting quality and other criteria were combined in this analysis, which showed a statistically significant reduction in ARF (RR=0.62) from school or mixed school / community based primary prevention interventions. Both community-wide and combined community / school GAS sore throat interventions were effective at reducing the incidence of ARF.

Å Serious Skin Infection

Introduction

Bacterial skin infections are a common cause of hospitalisation in children, with the most frequently implicated organisms being *Staphylococcus aureus* and *Streptococcus pyogenes* [237]. Common clinical presentations include:

Cellulitis: A diffuse infection of the skin and subcutaneous tissue characterised by local heat, redness, pain, swelling and occasionally fever, malaise, chills and headache. Infection is more likely to develop in the presence of damaged skin and abscesses / tissue destruction may occur if antibiotics are not taken. [202].

Furuncles and Carbuncles: Commonly known as an abscess or boil, furuncles form tender, red, firm / fluctuant masses of walled off purulent material. They arise from infections of the hair follicle (usually involving *S. aureus*), which then enlarge and eventually open to the skin surface, allowing the purulent contents to drain. Carbuncles are an aggregate of infected hair follicles that form a broad, swollen, red and painful mass that usually opens and drains through multiple tracts. Associated symptoms may include fever and malaise [238].

New Zealand's hospital admission rates for childhood skin infection have increased in recent years and are currently double those of the USA and Australia [239]. Admissions are highest during summer and are also higher for Māori and Pacific children and those living in the most deprived areas [239], with one local study finding hospital admissions for cellulitis / subcutaneous abscesses which were 3.89 times higher for Pacific children than for European children [237]. In developing interventions to reduce childhood skin infections, issues such as overcrowding, access to washing machines and first aid kits, exposure to insect bites, the cleaning and covering wounds, and access to primary health care may all need to be addressed simultaneously [239].

The following section explores skin infection rates in Pacific children and young people in New Zealand using information from the National Minimum Dataset and Mortality Collection. The section concludes with a review of policy and evidence based review documents which consider interventions to address skin infections at the population level.

Data Source and Methods

Definition

Hospital Admissions and Deaths due to Serious Skin Infections in Children and Young People Aged 0-24 years.

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions of children and young people (0-24 years) with a primary ICD-10 diagnosis of serious skin infection including: Staphylococcal Scaled Skin Syndrome (L00), Impetigo (L01), Cutaneous Abscess/Furuncle/Carbuncle (L02), Cellulitis (L03), Acute Lymphadenitis (L04), Pilonidal Cyst with Abscess (L05.0), and Other Local Infections of the Skin/Subcutaneous Tissue (L08).
Deaths Numerator: National Mortality Collection: Deaths in children and young people (0-24 years) where the main underlying cause of death (clinical code) was attributed to one of the serious skin infections identified above.
Denominator: NZ Census

Notes on Interpretation

Note 1: The serious skin infection coding utilised in this section differs slightly from that utilised in the ASH skin infection category in that a number of less serious infections (e.g. those to the eyelids) have been excluded, and others (e.g. pilonidal cyst with abscess) have been included, even though they may not be entirely preventable in primary care. In addition, *Appendix 4: The National Minimum Dataset* outlines the limitations of the hospital admission data used.
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category

Admissions: Proxy B-C; Mortality: Ideal B

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1990-2007, hospital admissions for serious skin infections rose progressively, with the most rapid rises occurring during the mid-late 1990s (**Figure 100**). During 1990-2005, two deaths were attributed to serious skin infections in this age group.

New Zealand Age Distribution

In New Zealand during 2003-2007, hospital admissions for serious skin infections had a bi-modal distribution, with the highest rates occurring in children <5 years of age, followed by young people in their late teens and early 20s (**Figure 101**).

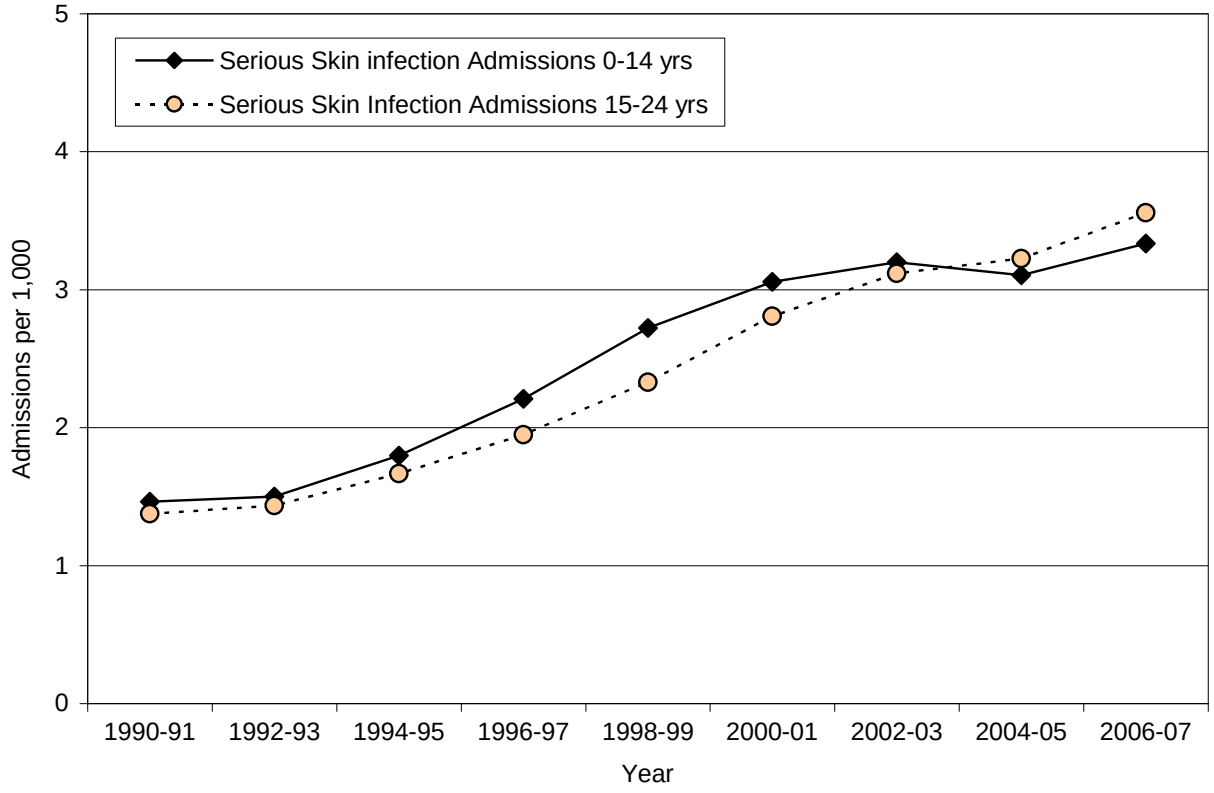
Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

In New Zealand during 2003-2007, admissions for serious skin infections were *significantly higher* for Pacific > Māori > European and Asian children, Pacific and Māori > European > Asian young people, males and those living in urban or deprived areas (**Table 75**, **Table 76**). Similarly, during 1996-2007, while hospital admissions for serious skin infections increased for all ethnic groups, rates remained persistently higher for Pacific > Māori > European > Asian children and young people. Rates were also higher for Sole Pacific than for Any Pacific children and young people during this period (**Figure 102**).

Distribution by Season

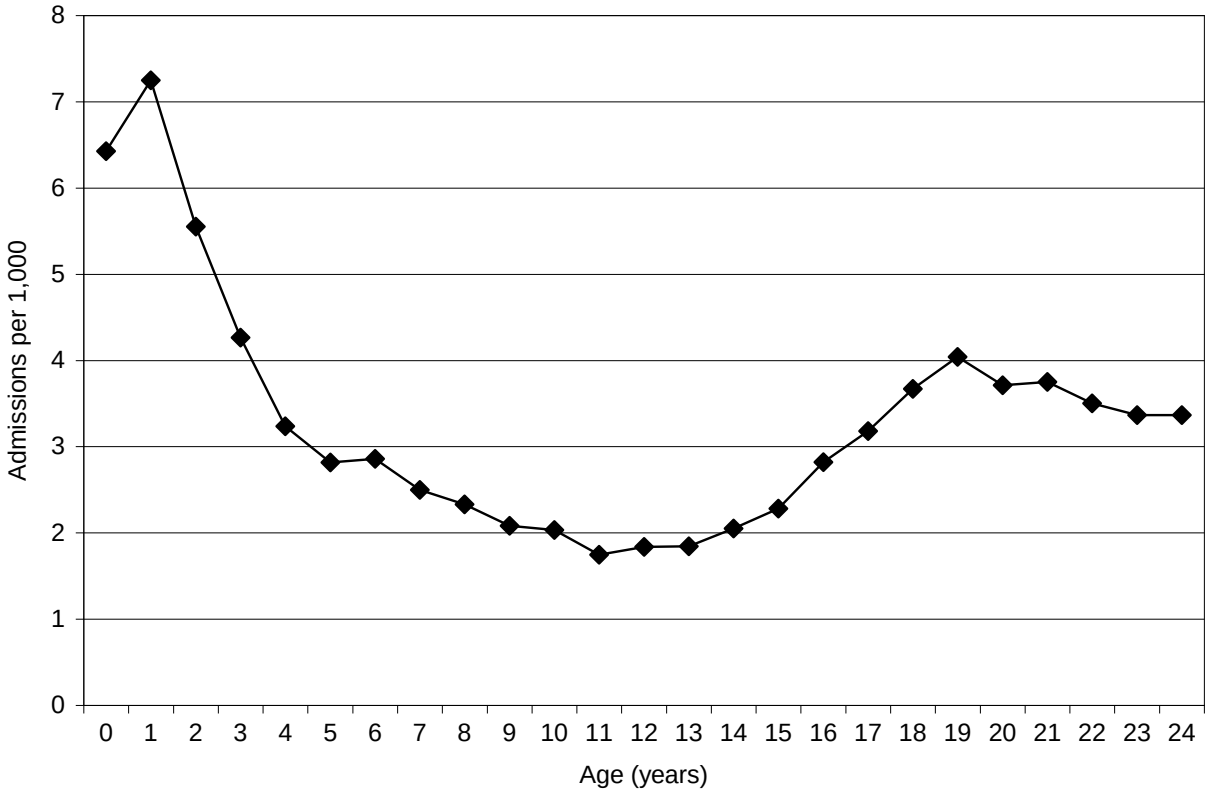
In New Zealand during 2003-2007, hospital admissions for serious skin infections in children and young people were generally higher in summer and autumn (**Figure 103**).

Figure 100. Hospital Admissions for Serious Skin Infections in Children and Young People 0-24 Years, New Zealand 1990-2007



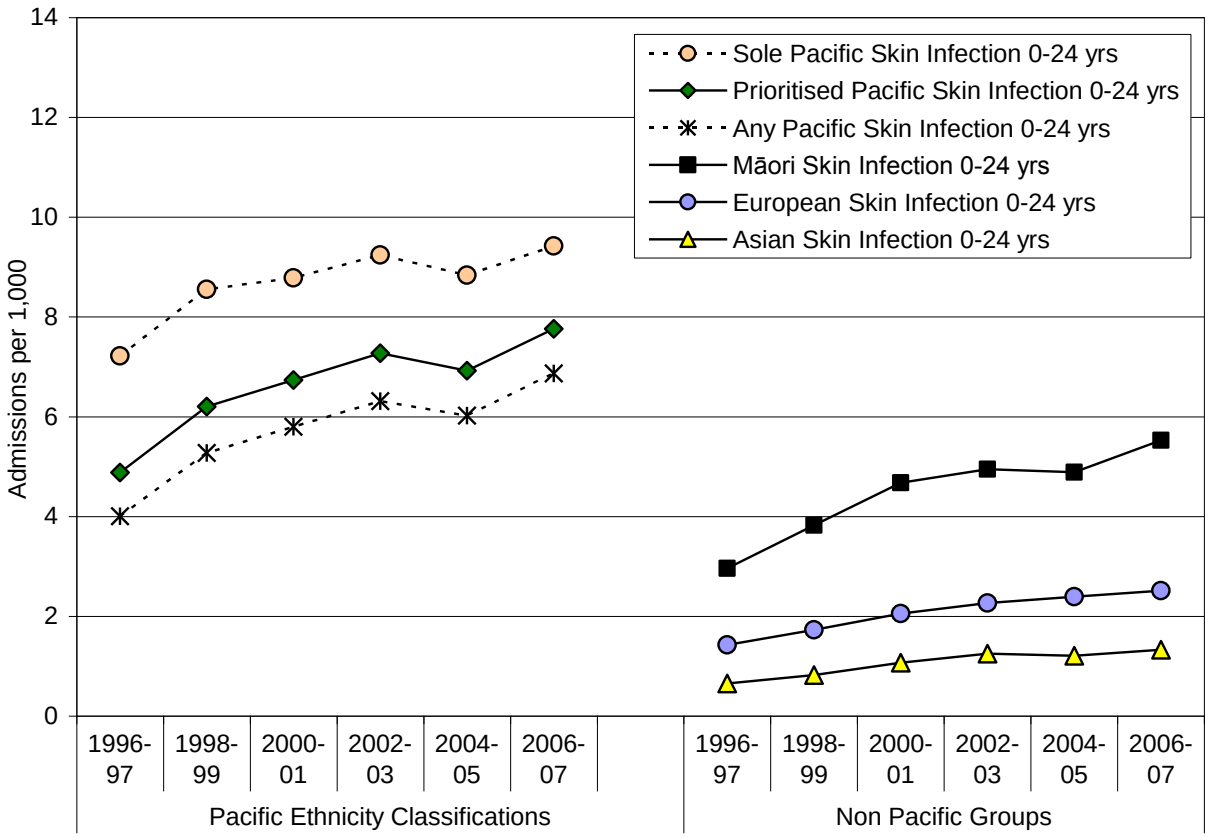
Source: Numerator-National Minimum Dataset; Denominator-Census

Figure 101. Hospital Admissions for Serious Skin Infections in Children and Young People 0-24 Years by Age, New Zealand 2003-2007



Source: Numerator-National Minimum Dataset; Denominator-Census.

Figure 102. Hospital Admissions for Serious Skin Infections in Children and Young People 0-24 Years by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Table 75. Risk Factors for Hospital Admissions due to Serious Skin Infections in Children 0-14 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	1.30	1.00		1-2	1.38	1.00	
2	1.46	1.12	1.00 - 1.25	3-4	1.86	1.35	1.25 - 1.46
3	1.66	1.28	1.14 - 1.42	5-6	2.34	1.70	1.58 - 1.83
4	2.07	1.59	1.43 - 1.76	7-8	3.74	2.71	2.54 - 2.90
5	1.89	1.45	1.30 - 1.61	9-10	5.98	4.34	4.08 - 4.62
6	2.80	2.15	1.95 - 2.38	Prioritised Ethnicity			
7	3.13	2.40	2.18 - 2.65	European	1.87	1.00	
8	4.33	3.32	3.03 - 3.65	Māori	5.34	2.86	2.75 - 2.98
9	5.19	3.99	3.64 - 4.37	Pacific	8.42	4.51	4.31 - 4.72
10	6.64	5.10	4.67 - 5.56	Asian	1.73	0.93	0.85 - 1.01
Gender				Urban / Rural			
Female	3.03	1.00		Urban	3.47	1.00	
Male	3.37	1.11	1.08 - 1.15	Rural	1.72	0.50	0.47 - 0.53

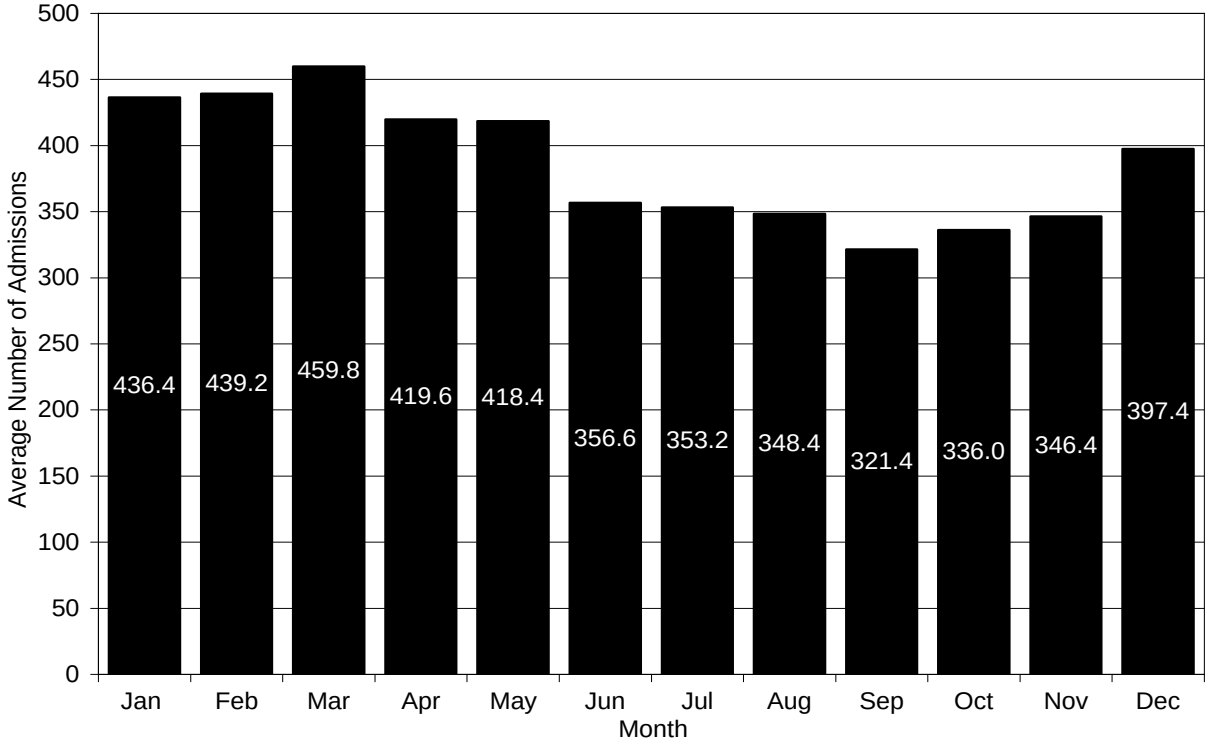
Source: Numerator-National Minimum Dataset; Denominator-Census; Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Table 76. Risk Factors for Hospital Admissions due to Serious Skin Infections in Young People 15-24 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	2.00	1.00		1-2	2.14	1.00	
2	2.27	1.14	1.00 - 1.29	3-4	2.47	1.16	1.06 - 1.26
3	2.09	1.05	0.93 - 1.19	5-6	3.07	1.44	1.33 - 1.55
4	2.85	1.42	1.27 - 1.60	7-8	3.69	1.73	1.60 - 1.86
5	2.88	1.44	1.28 - 1.62	9-10	4.64	2.17	2.02 - 2.33
6	3.25	1.62	1.45 - 1.82	Prioritised Ethnicity			
7	3.36	1.68	1.51 - 1.88	European	3.24	1.00	
8	4.00	2.00	1.80 - 2.23	Māori	4.78	1.47	1.40 - 1.55
9	4.49	2.25	2.03 - 2.49	Pacific	5.17	1.59	1.49 - 1.70
10	4.80	2.40	2.17 - 2.66	Asian	0.87	0.27	0.24 - 0.30
Gender				Urban / Rural			
Female	2.56	1.00		Urban	3.41	1.00	
Male	4.12	1.61	1.54 - 1.68	Rural	2.79	0.82	0.76 - 0.88

Source: Numerator-National Minimum Dataset; Denominator-Census; Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

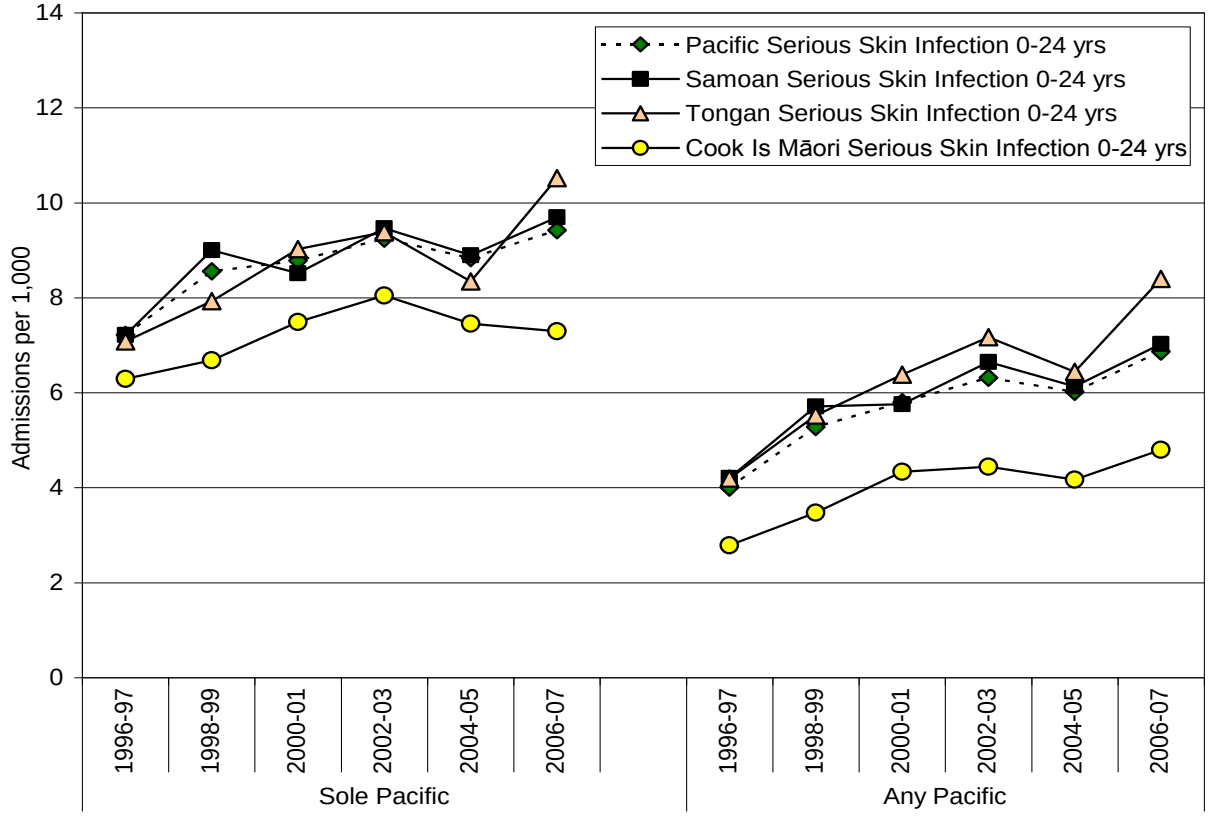
Figure 103. Average Number of Hospital Admissions for Serious Skin Infections per Month in Children and Young People Aged 0-24 Years, New Zealand 2003-2007



Source: National Minimum Dataset

Serious Skin Infection Admissions Amongst Pacific Groups in New Zealand

Figure 104. Hospital Admissions due to Serious Skin Infections in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Table 77. Distribution of Hospital Admissions due to Serious Skin Infections in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 2003-2007

Any Pacific										
Pacific Group	Children 0-14 Years					Young People 15-24 Years				
	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	1,779	355.8	7.27	4.00	3.78-4.21	587	117.4	5.09	1.80	1.65-1.95
Any Tongan	841	168.2	8.19	4.50	4.19-4.84	222	44.4	5.36	1.89	1.65-2.16
Any Cook Island Māori	601	120.2	5.13	2.82	2.59-3.06	158	31.6	2.95	1.04	0.89-1.22
Any Niuean	208	41.6	4.74	2.60	2.27-2.99	73	14.6	3.47	1.22	0.97-1.54
Any Fijian	65	13.0	4.33	2.38	1.86-3.04	36	7.2	4.04	1.43	1.03-1.98
Any Tokelauan	77	15.4	5.46	3.00	2.40-3.75	19	3.8	3.06	1.08	0.69-1.69
Any Other Pacific	130	26.0	8.77	4.82	4.05-5.73	44	8.8	5.94	2.09	1.56-2.81
Any Pacific	3,510	702.0	7.14	3.92	3.76-4.09	1,125	225.0	4.79	1.69	1.58-1.80
Any Māori	5,322	1,064.4	5.34	2.93	2.83-3.05	2,374	474.8	4.78	1.68	1.61-1.77
Non-Māori Non-Pacific	5,371	1,074.2	1.82	1.00		5,942	1,188.4	2.84	1.00	
Sole Pacific										
Pacific Group	Children 0-14 Years					Young People 15-24 Years				
	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	1,375	275.0	10.94	6.01	5.67-6.38	476	95.2	6.49	2.29	2.08-2.51
Sole Tongan	658	131.6	10.94	6.01	5.54-6.51	175	35.0	6.29	2.22	1.91-2.58
Sole Cook Island Māori	410	82.0	9.76	5.36	4.85-5.92	103	20.6	3.81	1.34	1.11-1.63
Sole Niuean	93	18.6	10.51	5.77	4.71-7.08	40	8.0	5.53	1.95	1.43-2.66
Sole Fijian	40	8.0	8.54	4.69	3.44-6.39	14	2.8	3.68	1.30	0.77-2.19
Sole Tokelauan	41	8.2	11.08	6.09	4.49-8.26	8	1.6	3.02	1.06	0.53-2.13
Sole Other Pacific	104	20.8	16.67	9.15	7.55-11.10	35	7.0	9.62	3.39	2.44-4.72
Sole Pacific	2,736	547.2	10.89	5.98	5.71-6.26	875	175.0	6.01	2.12	1.97-2.27
Sole Māori	4,325	865.0	10.10	5.55	5.33-5.77	1,960	392.0	7.90	2.79	2.65-2.93
Non-Māori Non-Pacific	5,371	1,074.2	1.82	1.00		5,942	1,188.4	2.84	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted.

Pacific Group Trends
During 1996-2007 (using the Sole / Any classification), serious skin infection admissions were consistently higher for Tongan and Samoan children and young people than for Cook Island Māori children and young people in both the Sole and Any Categories (**Figure 104).**

Distribution by Pacific Group
Children: During 2003-2007 (using the Sole / Any classification), serious skin infection admissions were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Pacific groups. Within the Any Category, admissions were *significantly higher* for Samoan, Tongan and "Other" Pacific children than for Cook Island Māori, Niue, Tokelauan and Fijian children. Within the Sole Category however, differences between individual Pacific groups were much less marked.

Young People: During the same period, only admissions for Any and Sole Samoan, Tongan and 'Other" Pacific young people, Any Fijian and Sole Cook Island Māori and Niue young people were *significantly higher* than for non-Māori non-Pacific young people (**Table 77**).

Summary
In New Zealand during 1990-2007, hospital admissions for serious skin infections rose progressively, with the most rapid rises occurring during the mid-late 1990s. During 2003-2007, admissions had a bi-modal distribution, with the highest rates occurring in children <5 years of age, followed by young people in their late teens and early 20s. Admissions were also *significantly higher* for Pacific > Māori > European and Asian children, Pacific and Māori > European > Asian young people, males and those in urban or deprived areas.

Amongst children during 2003-2007 (using the Sole / Any classification), serious skin infection admissions were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any Pacific groups. Within the Any Category, admissions were *significantly higher* for Samoan, Tongan and "Other" Pacific children than for Cook Island Māori, Niue, Tokelauan and Fijian children. Within the Sole Category however, differences between individual Pacific groups were much less marked. Amongst young people, only admissions for Any and Sole Samoan, Tongan and 'Other" Pacific young people, Any Fijian and Sole Cook Island Māori and Niue young people were *significantly higher* than for non-Māori non-Pacific young people.

Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Skin Infections
In New Zealand there are no policy documents which focus solely on the prevention of serious skin infections. A range of documents however consider approaches infectious diseases and their risk factors more generally. These have been reviewed in other sections of this report:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 31 on Page 119
2. **Interventions Aimed at Housing and Household Crowding:** Table 33 on Page 121
3. **Strategies to Improve Access to Primary Care:** Table 28 on Page 108

There is also a paucity of evidence based reviews in the international literature which consider effective interventions to reduce serious skin infections at the population level. One recent local review of serious skin infections in the Wellington region however, may provide a useful starting point for DHBs wishing to undertake initiatives in this area (see **Table 78**).

Table 78. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Skin Infections

Ministry of Health Policy Documents
In New Zealand there are no policy documents which focus solely on the prevention of skin infections, although a range of documents consider the prevention of infectious diseases more generally (see links on previous page) There are also aspects of the Local Government Act 2002/Local Government Amendment Act 2004 and the Health (drinking water) Amendment Act 2007 that potentially have implications for skin sepsis and other infectious diseases. This legislation requires that water companies must ensure that households have adequate water to meet minimum drinking, food preparation and sanitary needs even if they do not or are unable to pay their water bill.
Systematic and Other Reviews from the International Literature
Fernandez R, Griffiths R. **Water for Wound Cleansing**. Cochrane Database of Systematic Reviews 2008, Issue 1. This review assessed the effects of water compared with other solutions for wound cleansing. Water is frequently used for cleaning wounds to prevent infection. This can be tap water, distilled water, cooled boiled water or saline (salty water). Using tap water to cleanse acute wounds in adults does not increase the infection rate; however, there is no strong evidence that cleansing per se is better than not cleansing. The reviewers concluded that where tap water is high quality, it may be as good as other methods (and more cost-effective), but more research is needed.
Other Relevant Publications
Hunt D. **Assessing and Reducing the Burden of Serious Skin Infections in Children and Young People in the Greater Wellington Region**. Capital and Coast DHB. 2004, Hutt Valley DHB, Regional Public Health: Wellington. http://skininfections.co.nz/documents/Serious_Skin_Infections_Nov2004.pdf This document summarises a project undertaken in Wellington to reduce the overall burden of, and disparities in, serious skin infections in children and young people, and to reduce hospital admission rates through prevention and early intervention of disease. The project identified a number of key determinants of skin sepsis, and a number of key interventions which were potentially effective, feasible, supported existing services, and captured the interest of providers, stakeholders and the community. A list of recommendations is also provided that are particularly relevant to DHBs.
Eady E, Cove J. **Staphylococcal Resistance Revisited: Community Acquired Methicillin Resistant Staphylococcus Aureus - An Emerging Problem For The Management of Skin and Soft Tissue Infections**. Current Opinion in Infectious Diseases, 2003. 16(2): 103-24. This review of Staphylococcal resistance suggests that improved hygiene offers a very reasonable approach to prevent the spread of Community Acquired Methicillin-Resistant Staphylococcus Aureus (CA-MRSA) in children and that parents, carers, teachers and childcare providers all have an important role to play in helping children to learn and use vigorous hand-washing.

Å Infectious Gastroenteritis

Introduction

Acute gastroenteritis is a clinical syndrome produced by a variety of viral, bacterial and parasitic organisms. It results in inflammation of the stomach and intestines, leading to anorexia, nausea, vomiting, diarrhoea, fever, and abdominal discomfort. Onset is often abrupt and may result in the rapid loss of fluids and electrolytes [202]. Transmission is generally by the faecal-oral route, with the incubation period varying depending on the causative organism. In terms of aetiology, in one recent NZ study, 56% of hospital admissions with gastroenteritis (< 5 years of age) were of unknown aetiology, 41% were attributed to viruses and the remaining 3% to bacterial or parasitic causes [240].

In New Zealand gastroenteritis is among the top 10 causes of hospital admissions amongst children, with admissions peaking during the winter months. [240]. Risk factors include young age (highest <2 years), Māori and Pacific ethnicity [240], a lack of breastfeeding, and attendance at day care [241]. In terms of reducing the burden of disease, it has been suggested that up to 60% of hospital admissions for gastroenteritis <5 years may be attributable to rotavirus infection [240], with one recent study estimating that 1 in 52 New Zealand children are hospitalised with rotavirus before they reach 3 years of age [242]. While an expensive rotavirus vaccine is currently available in the USA, it is hoped that the cost per dose will decrease as production increases, potentially offering an avenue for prevention in future years. In the meantime, improved access to oral rehydration solutions in the primary care setting and initiatives to promote breastfeeding may be of value in reducing admission rates at a population level.

The following section explores gastroenteritis rates in Pacific children and young people in New Zealand children using information from the National Minimum Dataset and Mortality Collection. The section concludes with a review of policy and evidence based review documents which consider interventions to address gastroenteritis at the population level.

Data Source and Methods

Definition

Hospital Admissions and Deaths due to Gastroenteritis in Children and Young People Aged 0-24 years

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions of children and young people (0-24 years) with a primary ICD-10 diagnosis of infectious gastroenteritis (A00-A09) or Nausea and Vomiting (R11)
Deaths Numerator: National Mortality Collection: Deaths in children and young people (0-24 years) where the main ICD-10 underlying cause of death was infectious gastroenteritis (ICD-10 A00-A09) or Nausea and Vomiting (R11).
Denominator: NZ Census

Notes on Interpretation

Note 1: As a result of a change in coding for gastroenteritis in the Ministry of Health's ASH algorithm, (K52: Other Non-infective gastroenteritis and colitis has been removed), rates in this section may differ slightly from those presented in previous years. In addition, the conditions included above differ slightly from the ASH gastroenteritis coding algorithm (A00-A01:Cholera, Typhoid and Paratyphoid Fevers have been included for completeness, having been excluded from the ASH algorithm on the basis that primary care is unlikely to be able to manage these conditions). In the New Zealand context however, it is unlikely that this will result in material differences in admission rates. In addition, *Appendix 4: The National Minimum Dataset* outlines the limitations of the hospital admission data used.
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category

Admissions: Proxy C; Mortality: Ideal B

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1990-2007, hospital admissions for infectious gastroenteritis increased in both children and young people. Despite this, deaths remained static at around 1-2 cases per year during 1990-2005 (**Figure 105**).

New Zealand Age Distribution

In New Zealand during 2003-2007, infectious gastroenteritis admissions were highest in children <3 years, but tapered off rapidly thereafter. Mortality during 2001-2005 followed a similar pattern (**Figure 106**).

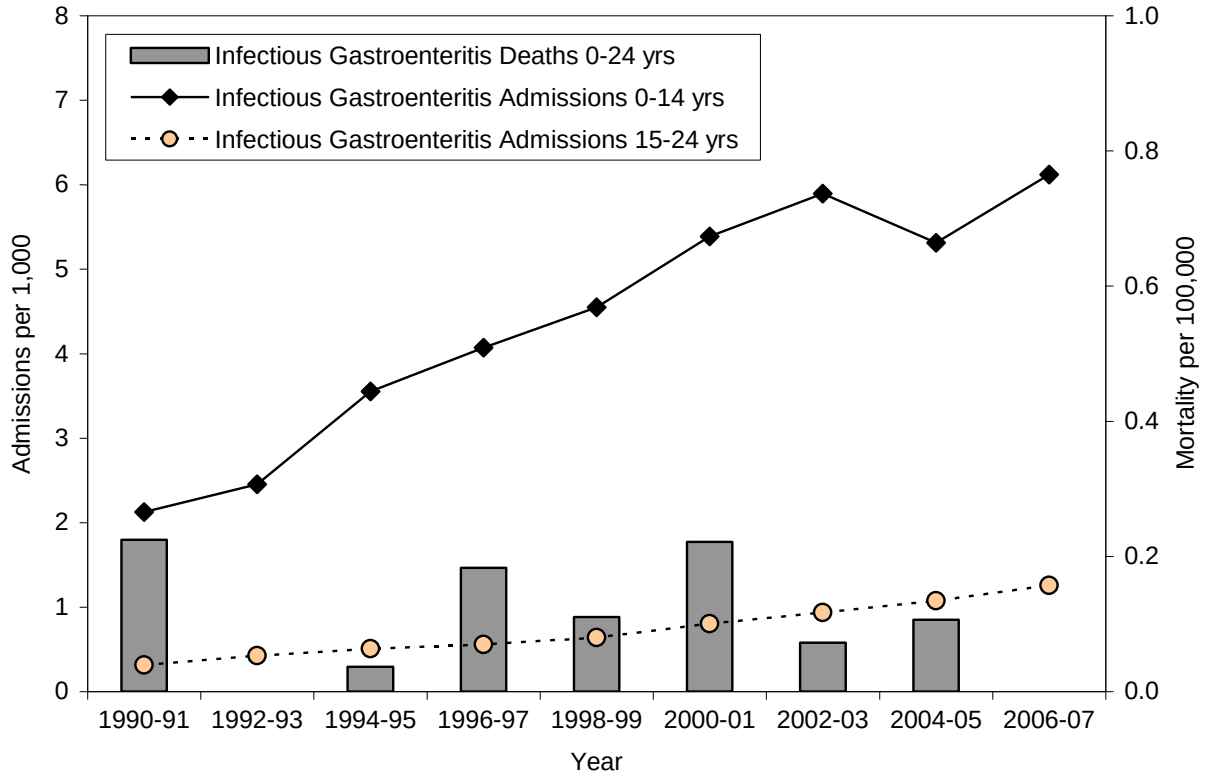
Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

In New Zealand during 2003-2007, infectious gastroenteritis admissions were *significantly higher* for Pacific > Asian > European > Māori children, males and those living in urban or deprived areas (**Table 79**). Similarly during 1996-2007, while gastroenteritis admissions increased for all ethnic groups, rates remained higher for Pacific children and young people. Rates for Sole Pacific children and young people were also consistently higher than for Any Pacific children and young people during this period (**Figure 107**).

Distribution by Season

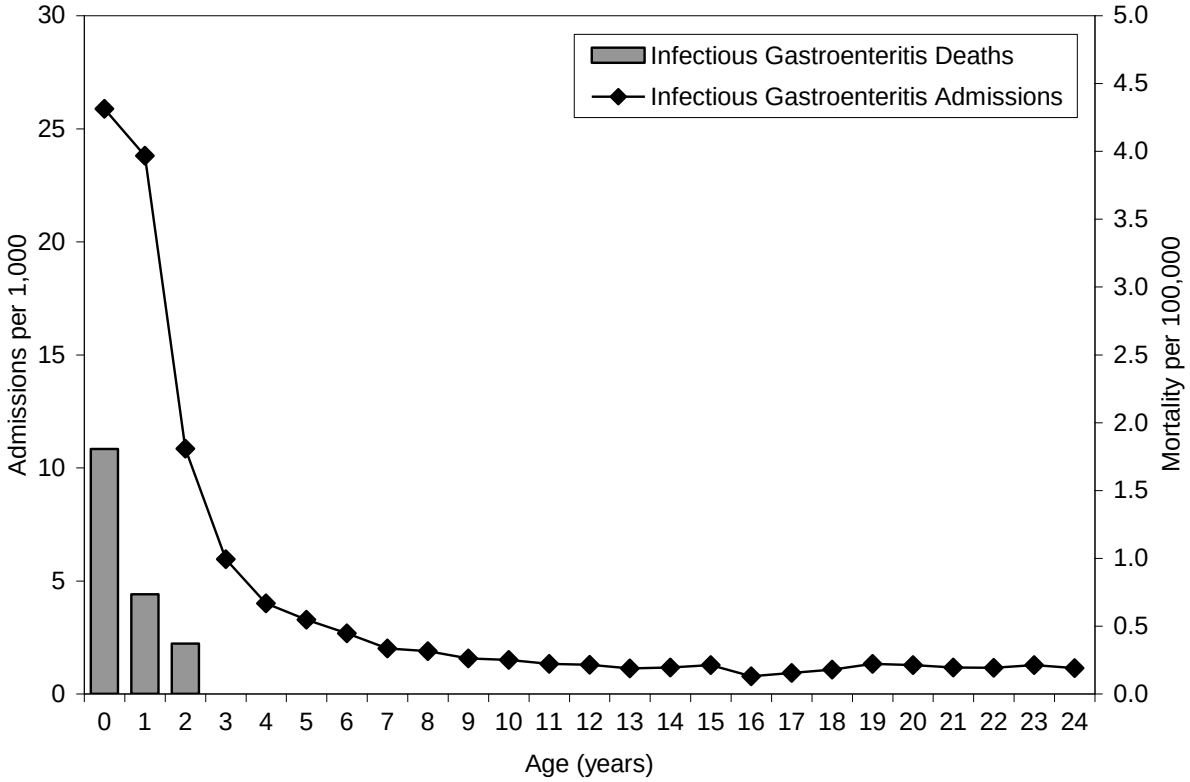
In New Zealand during 2003-2007, gastroenteritis admissions in children and young people were highest during spring (**Figure 108**).

Figure 105. Hospital Admissions (1990-2007) and Deaths (1990-2005) due to Infectious Gastroenteritis in New Zealand Children and Young People 0-24 Years



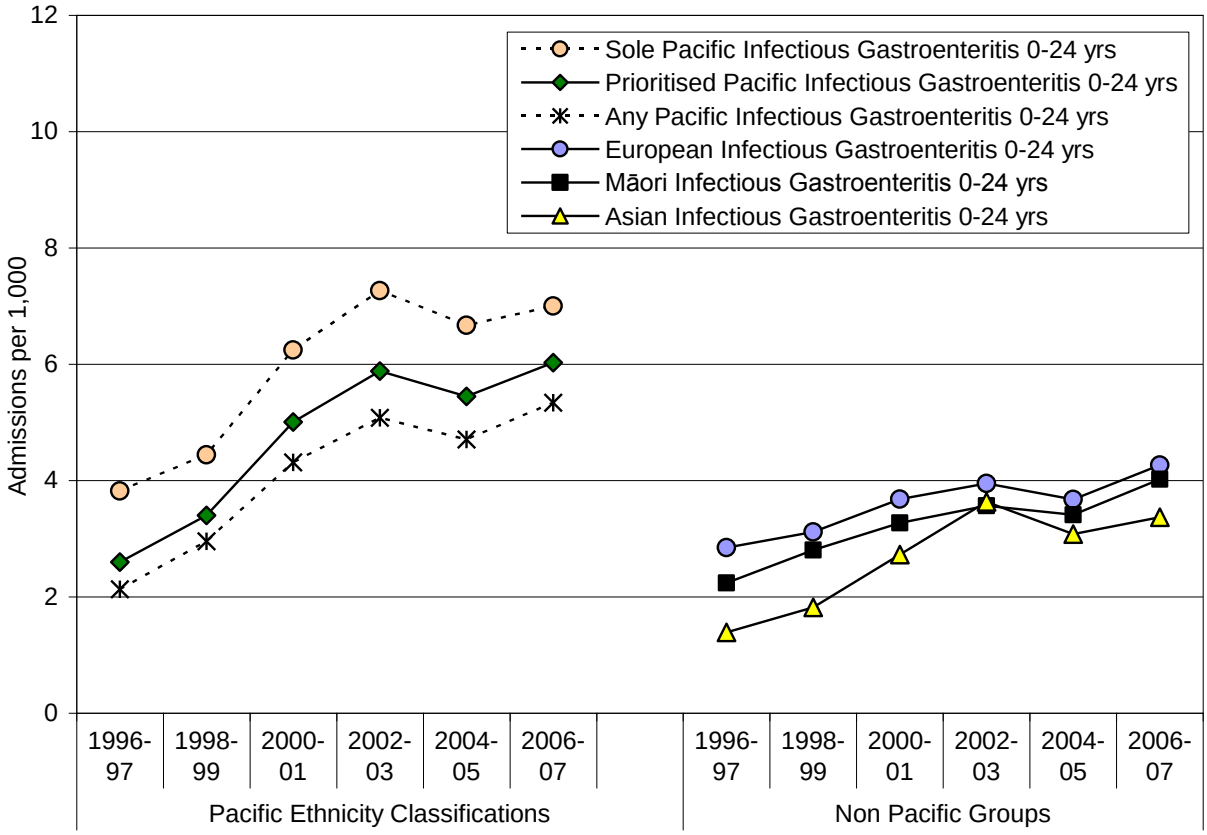
Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census. Note: Mortality data unavailable for 2006-07.

Figure 106. Hospital Admissions (2003-2007) and Deaths (2001-2005) due to Infectious Gastroenteritis by Age in New Zealand Children and Young People 0-24 Years



Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census

Figure 107. Hospital Admissions due to Infectious Gastroenteritis in Children and Young People 0-24 Years by Ethnicity, New Zealand 1996-2007



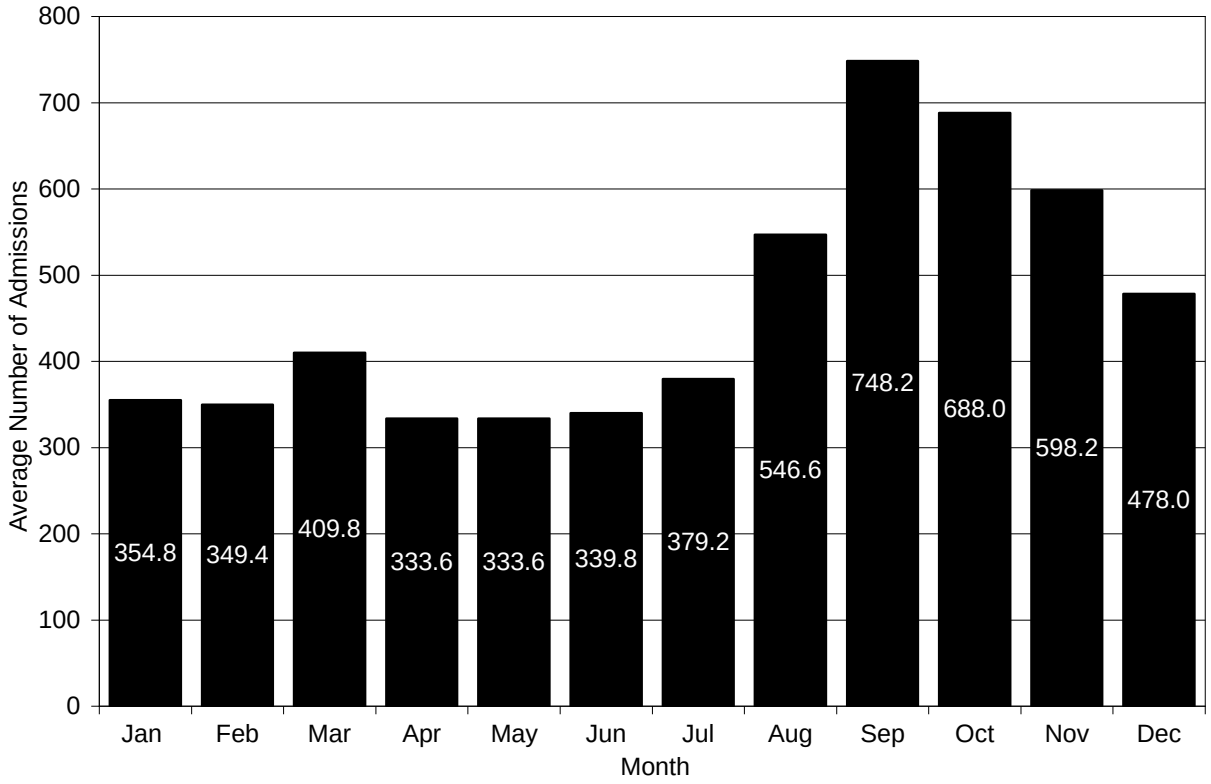
Source: Numerators-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Table 79. Risk Factors for Hospital Admissions due to Infectious Gastroenteritis in Children 0-14 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	3.63	1.00		1-2	3.56	1.00	
2	3.49	0.96	0.90 - 1.03	3-4	4.37	1.23	1.17 - 1.29
3	3.96	1.09	1.02 - 1.17	5-6	5.45	1.53	1.46 - 1.60
4	4.79	1.32	1.23 - 1.41	7-8	6.97	1.96	1.87 - 2.04
5	4.84	1.33	1.25 - 1.42	9-10	7.59	2.13	2.04 - 2.22
6	6.06	1.67	1.57 - 1.78	Prioritised Ethnicity			
7	6.03	1.66	1.56 - 1.77	European	5.65	1.00	
8	7.87	2.17	2.04 - 2.30	Māori	5.08	0.90	0.87 - 0.93
9	7.93	2.18	2.06 - 2.31	Pacific	8.18	1.45	1.39 - 1.51
10	7.31	2.01	1.90 - 2.13	Asian	6.03	1.07	1.02 - 1.12
Gender				Urban / Rural			
Female	5.54	1.00		Urban	6.14	1.00	
Male	5.87	1.06	1.03 - 1.09	Rural	3.22	0.52	0.50 - 0.55

Source: Numerator-National Minimum Dataset; Denominator-Census; Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted

Figure 108. Average Number of Hospital Admissions due to Infectious Gastroenteritis per Month in Children and Young People 0-24 Years, New Zealand 2003-2007



Source: National Minimum Dataset

Gastroenteritis Admissions Amongst Pacific Groups in New Zealand

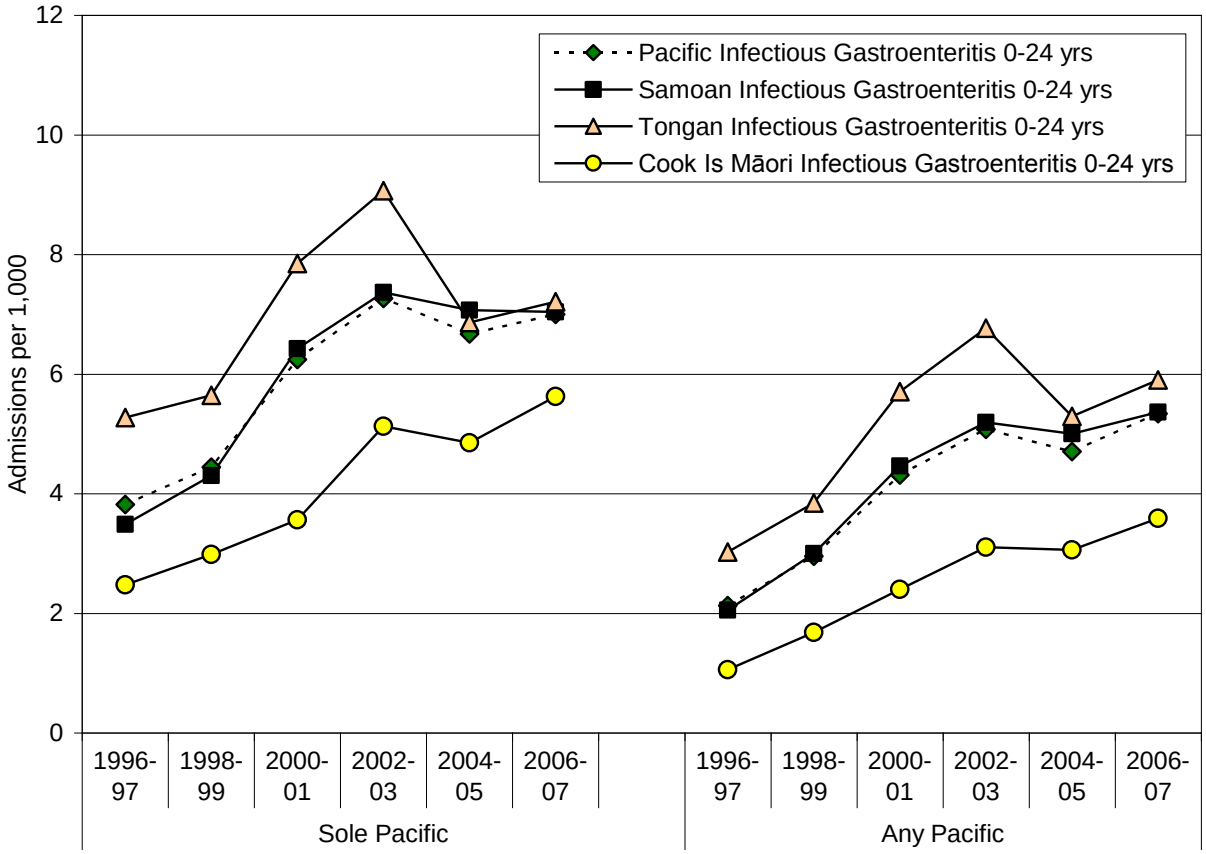
Pacific Group Trends

During 1996-2007, gastroenteritis admissions were consistently higher for Tongan and Samoan children and young people than for Cook Island Māori children and young people in both the Sole and Any Categories. In addition, rates were higher for Sole than for Any Pacific children and young people in each of these three ethnic groups (**Figure 109**).

Distribution by Pacific Group

During 2003-2007 (using the Sole / Any Classification), gastroenteritis admissions for all of the Pacific groups within the Sole Category were *significantly higher* than for non-Māori non-Pacific children. Within the Any Category, gastroenteritis admissions were *significantly higher* for Samoan, Tongan, Fijian and Other Pacific children than for non-Māori non-Pacific children. In contrast, admission rates for Any Cook Island Māori and Niuean children were *significantly lower* (**Table 80**).

Figure 109. Hospital Admissions due to Infectious Gastroenteritis in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Table 80. Distribution of Hospital Admissions due Infectious Gastroenteritis in Pacific Children 0-14 Years by Pacific Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	1,742	348.4	7.12	1.27	1.21-1.33
Any Tongan	774	154.8	7.54	1.35	1.25-1.45
Any Cook Island Māori	516	103.2	4.40	0.79	0.72-0.86
Any Niuean	181	36.2	4.13	0.74	0.64-0.85
Any Fijian	155	31.0	10.33	1.84	1.57-2.16
Any Tokelauan	65	13.0	4.61	0.82	0.65-1.05
Any Other Pacific	107	21.4	7.22	1.29	1.07-1.56
Any Pacific	3,393	678.6	6.90	1.23	1.19-1.28
Any Māori	5,059	1,011.8	5.08	0.91	0.88-0.93
Non-Māori Non-Pacific	16,536	3,307.2	5.61	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	1,317	263.4	10.48	1.87	1.77-1.98
Sole Tongan	607	121.4	10.09	1.80	1.66-1.95
Sole Cook Island Māori	322	64.4	7.67	1.37	1.23-1.53
Sole Niuean	84	16.8	9.49	1.69	1.37-2.10
Sole Fijian	63	12.6	13.44	2.40	1.88-3.07
Sole Tokelauan	36	7.2	9.73	1.74	1.25-2.40
Sole Other Pacific	83	16.6	13.30	2.37	1.92-2.94
Sole Pacific	2,538	507.6	10.10	1.80	1.73-1.88
Sole Māori	3,681	736.2	8.60	1.53	1.48-1.59
Non-Māori Non-Pacific	16,536	3,307.2	5.61	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted.

Summary

In New Zealand during 1990-2007, gastroenteritis admissions increased in both children and young people. Despite this, deaths remained static at around 1-2 cases per year during 1990-2005. During 2003-2007, gastroenteritis admissions were highest for children <3 years of age, but tapered off rapidly thereafter. Mortality during 2001-2005 followed a similar pattern. During 2003-2007, gastroenteritis admissions were also *significantly higher* for Pacific > Asian > European > Māori children, males and those living in urban or deprived areas. Admissions were also higher during spring.

During 2003-2007 (using the Sole / Any Classification), gastroenteritis admissions for all of the Pacific groups within the Sole Category were *significantly higher* than for non-Māori non-Pacific children. Within the Any Category, admissions were *significantly higher* for Samoan, Tongan, Fijian and Other Pacific children than for non-Māori non-Pacific children. In contrast, admissions for Any Cook Island Māori and Niuean children were *significantly lower.*

Policy Documents and Evidence Based Reviews Relevant to the Prevention and Management of Gastroenteritis

In New Zealand there are no policy documents which focus solely on the prevention of gastroenteritis. A range of documents however consider approaches to infectious diseases and their risk factors more generally, and these have been reviewed in other sections:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 31 on Page 119
2. **Interventions Aimed at Housing and Household Crowding:** Table 33 on Page 121
3. **Interventions Aimed at Breastfeeding:** Breastfeeding Section on Page 58
4. **Strategies to Improve Access to Primary Care:** Table 28 on Page 108

In addition, a range of international reviews consider the most effective approaches to the prevention and management of gastroenteritis and these are briefly summarised in **Table 81**.

Table 81. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention and Management of Gastroenteritis

Ministry of Health Policy Documents
In New Zealand there are no policy documents which focus solely on the prevention of gastroenteritis, although a range of documents consider the prevention of infectious diseases more generally (see links on previous page) There are also aspects of the Local Government Act 2002/Local Government Amendment Act 2004 and the Health (drinking water) Amendment Act 2007 that potentially have implications for gastroenteritis and other infectious diseases. This legislation requires that water companies must ensure that households have adequate water to meet minimum drinking, food preparation and sanitary needs even if they do not or are unable to pay their water bill.
Ministry of Health, **Communicable Disease Control Manual**. Public Health Group, Editor. 1998, Ministry of Health. The Communicable Disease Control Manual was developed to provide information on the prevention and control of communicable diseases in New Zealand. The manual includes a range of national protocols, including those relating to acute gastroenteritis and a variety specific pathogens (e.g. campylobacter, salmonella, giardia) Note: the manual is currently under review and a new edition is expected in the near future.
Systematic and Other Reviews from the International Literature
Ejemot R, Ehiri J, Meremikwu M, Critchley J. **Hand Washing for Preventing Diarrhoea**. Cochrane Database of Systematic Reviews 2008, Issue 1. This review evaluated the effectiveness of interventions to promote hand washing on the occurrence of diarrhoeal episodes in children and adults. It considered trials of interventions to increase the use of hand washing in institutions in high-income countries and in communities in low or middle-income countries, and found many interventions to be effective (e.g. educational programmes, leaflets, discussions).
Freedman S. **Acute Infectious Pediatric Gastroenteritis: Beyond Oral Rehydration Therapy**. Expert Opinion on Pharmacotherapy, 2007. 8 (11):1651-65. This article reviews advances in the pharmacological management of gastroenteritis including the development of new vaccines against rotavirus; research into anti-secretory agents; the use of the antiemetic agent ondansetron for gastroenteritis in children; the use of probiotic agents in acute infectious gastroenteritis and; more aggressive intravenous rehydration strategies.
Hartling L, Bellemare S, Wiebe N, et al. **Oral Versus Intravenous Rehydration for Treating Dehydration due to Gastroenteritis in Children**. Cochrane Database of Systematic Reviews 2006, Issue 3 This review compared oral vs. intravenous therapy for treating dehydration due to acute gastroenteritis in children. The review of 17 trials (some funded by drug companies) found the trials were not of high quality; however the evidence suggested that there are no clinically important differences between giving fluids orally or intravenously. The authors noted that for every 25 children treated with fluids orally, one child would fail and require intravenous rehydration. The authors recommend that oral rehydration should be the first line of treatment in children with mild to moderate dehydration, with intravenous therapy being used if the oral route fails. The evidence showed that there may be a higher risk of paralytic ileus with oral rehydration while intravenous therapy carries the risk of phlebitis (inflammation of the veins).

Alhashimi D, Alhashimi H, Fedorowicz Z. **Antiemetics for Reducing Vomiting Related to Acute Gastroenteritis in Children and Adolescents.** Cochrane Database of Systematic Reviews 2006, Issue 4.

This review assessed the effectiveness of antiemetics on gastroenteritis induced vomiting in children and adolescents. Three trials involving 396 participants were included and the authors concluded that the small number of trials provided some, albeit weak and unreliable, evidence which favoured the use of ondansetron and metoclopramide over placebo to reduce the number of episodes of vomiting due to gastroenteritis in children. The increased incidence of diarrhoea noted with both ondansetron and metoclopramide was considered to be as a result of retention of fluids and toxins that would otherwise have been eliminated through the process of vomiting.

Soares-Weiser K, Goldberg E, Tamimi G, et al. **Rotavirus Vaccine for Preventing Diarrhoea**. Cochrane Database of Systematic Reviews 2004, Issue 1.

This review assessed rotavirus vaccines for the prevention of rotavirus diarrhoea, death, and adverse events. It found that rhesus rotavirus vaccines (particularly RRV-TV) and the human rotavirus vaccine 89-12 were efficacious in preventing diarrhoea caused by rotavirus and all-cause diarrhoea. The authors noted that evidence regarding safety, mortality or the prevention of severe outcomes was scarce and inconclusive. Bovine rotavirus vaccines were also efficacious, but safety data were not available. The authors recommend that randomised controlled trials should be performed simultaneously in high, middle, and low-income countries.

Other Relevant Publications

Neuwelt P, Simmons G (2006). **A Public Health Portrait of Severe Paediatric Gastroenteritis in the Auckland Region: Report of the 2005 Auckland Paediatric Gastroenteritis Investigation**. Auckland, Auckland Regional Public Health Service.

This report found that relative socioeconomic deprivation was a risk factor for paediatric infectious gastroenteritis and suggested this may be due to issues such as the number of people living in a household and access to hand washing and drying facilities.

Other Issues

Unintentional Injury

Introduction

Children: Outside of the perinatal period, injury is the leading cause of mortality for New Zealand children, with motor vehicle accidents being the leading cause of injury related death [243, 244] and falls being the leading cause of injury related hospital admission [245]. While males are over represented in nearly all injury categories, the type of injury also varies significantly with the developmental stage of the child. For example, deaths due to choking are highest amongst infants, while drowning deaths are highest amongst children 1-4 years [243]. Similarly, driveways pose a particular danger for pre-school children, with one recent study of driveway related motor vehicle injuries in Auckland children finding that 86% occurred in children <4 years, and that Māori and Pacific children accounted for 74% of cases [246]. An earlier case control study of 190 Auckland child pedestrians hospitalised or killed as a result of being hit by a motor vehicle on public roads also found that the risk of injury was inversely related to family socioeconomic status, and that Māori and Pacific children were 2-3 times more likely to be injured than other children [247]. In terms of interventions aimed at addressing the high rates of injury amongst New Zealand children, a number of existing prevention strategies have shown promise (e.g. child restraints, traffic calming), while some remain inadequately implemented (e.g. pool fencing) and others (e.g. interventions to reduce child non-traffic (e.g. driveway) deaths) remain to be developed and tested [243].

Young People: Injuries are also the leading cause of hospital admission and death amongst young people, with motor vehicle accidents being the single most frequent cause in both categories [244, 248]. Risk factors for injury related death include gender, ethnicity and age, with rates being highest amongst males, Māori young people and those in their late teens and early 20's [249]. Injury related hospital admissions show a similar pattern, although admissions due to falls, sport injuries and non-road traffic injuries have been lower amongst Māori than non-Māori in recent years [249].

The following section explores injury related hospital admissions and mortality from all causes for Pacific children and young people, before reviewing two injury categories in more detail: Unintentional Non-Transport Related Injuries, and injuries arising from Land Transport Accidents. The section concludes with a review of policy and evidence based review documents which consider interventions to address injuries at the population level.

Data Source and Methods

Definition

Hospital Admissions and Deaths from Injury in Children and Young People 0-24 Years

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions for children and young people 0-24 years with a primary diagnosis of injury (ICD-9 800-995: ICD-10 S00-T79). Causes of injury were assigned using the external cause code (E code). The following were excluded: 1) Those with an E code ICD-9 E870-879: ICD-10 Y40-Y84 (complications of medical/surgical care), ICD-9 E930-949 (adverse effects of drugs in therapeutic use) and ICD-9 E929, E969, E959 (late effects (>1 year) of injury); 2) Inpatient admissions with Emergency Medicine Specialty code (M05-M08) on discharge (see Appendix 4);

Deaths Numerator: National Mortality Collection: Deaths of children and young people 0-24 years with a clinical code (cause of death) attributed to injury (ICD-9 E800-995: ICD-10 V01-Y36). Excluded were deaths with an E code ICD-9 E870-879: ICD-10 Y40-Y84 (complications of medical/surgical care), ICD-9 E930-949 (adverse effects of drugs in therapeutic use) and ICD-9 E929, E969, E959 (late effects (>1 year) of injury).

Causes of Injury Numerator: Causes of injury were assigned using the first E code in ICD10 as follows: Transport Accidents, Pedestrian (V01-V09), Cyclist (V10-V19), Motorbike (V20-29), 3-Wheeler (V30-39), Vehicle Occupant (V40-79), Other Land Transport (V80-89, V98-99); Falls (W00-W19), Mechanical Forces: Inanimate (W20-W49), Mechanical Forces: Animate (W50-64), Drowning/Submersion (W65-74), Accidental Threat to Breathing (W75-W84), Electricity/Fire/Burns (W85-X19), Accidental Poisoning (X40-X49), Intentional Self Harm (X60-84), Assault (X85-Y09), Undetermined Intent (Y10-Y34).

Broader Categories included Transport Accidents (V01-V89, V98-V99) and Unintentional Non-Transport Injuries (W00-W74, W85-X49). Transport accidents were assigned to traffic or non-traffic related categories based on the fourth digit of the External Cause code as outlined in the ICD-10 Tabular List of Diseases. For time series analyses

broader diagnostic categories (as well as those relating to accidental threats to breathing, assault and self inflicted injuries) were also back mapped to ICD-9 (with coding for each of these categories available on request).

Denominator: NZ Census

Indicator Category

Admissions: Proxy C; Mortality: Ideal B

Notes on Interpretation

Note 1: The limitations of the National Minimum Dataset are discussed at length in Appendix 4. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data, particularly those which relate to injuries.

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Most Frequent Causes of Injury Admissions and Mortality

Injury Mortality

Children: During 2001-2005, accidental threats to breathing were the leading cause of injury related mortality for Any Pacific children, although the majority of deaths occurred in infants <1 year, raising the possibility of diagnostic transfer from the SUDI category (see Infant Mortality section). Pedestrian injuries and drowning / submersion also made a significant contribution. In contrast, pedestrian injuries were the leading cause of injury mortality for Sole Pacific children, followed by accidental threats to breathing (**Table 82**).

Young People: During 2001-2005 intentional self harm, followed by vehicle occupant injuries, were the leading causes of injury related mortality for both Any and Sole Pacific young people (**Table 82**).

Table 82. Most Frequent Causes of Injury Related Mortality in Pacific Children 0-14 Years, New Zealand 2001-2005

Cause of Death	Number: Total 2001-2005	Number: Annual Average	Rate per 100,000	% of Deaths
Any Pacific				
Accidental Threat to Breathing	18	3.6	3.82	24.3
Transport: Pedestrian	17	3.4	3.61	23.0
Transport: Vehicle Occupant	7	1.4	1.49	9.5
Transport: Other	<5	s	s	s
Drowning / Submersion	13	2.6	2.76	17.6
Assault	<5	s	s	s
Falls	<5	s	s	s
All Other Causes	8	1.6	1.70	10.8
Total	74	14.8	15.71	100.0
Sole Pacific				
Transport: Pedestrian	12	2.4	4.89	29.3
Transport: Vehicle Occupant	5	1.0	2.04	12.2
Transport: Other	<5	s	s	s
Accidental Threat to Breathing	8	1.6	3.26	19.5
Drowning / Submersion	5	1.0	2.04	12.2
Assault	<5	s	s	s
Falls	<5	s	s	s
All Other Causes	5	1.0	2.04	12.2
Total	41	8.2	16.71	100.0

Source: Numerator-National Mortality Collection; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Table 83. Most Frequent Causes of Injury Related Mortality in Pacific Young People 15-24 Years, New Zealand 2001-2005

Cause of Death	Number: Total 2001-2005	Number: Annual Average	Rate per 100,000	% of Deaths
Any Pacific				
Intentional Self Harm	44	8.8	19.94	39.3
Transport: Vehicle Occupant	42	8.4	19.04	37.5
Transport: Other	5	1.0	2.27	4.5
Assault	5	1.0	2.27	4.5
Accidental Poisoning	<5	s	s	s
Drowning / Submersion	<5	s	s	s
Falls	<5	s	s	s
All Other Causes	<5	s	s	s
Total	112	22.4	50.77	100.0
Sole Pacific				
Intentional Self Harm	30	6.0	21.69	39.0
Transport: Vehicle Occupant	28	5.6	20.24	36.4
Transport: Other	<5	s	s	s
Assault	<5	s	s	s
Accidental Poisoning	<5	s	s	s
Drowning / Submersion	<5	s	s	s
Falls	<5	s	s	s
All Other Causes	<5	s	s	s
Total	77	15.4	55.67	100.0

Source: Numerator-National Mortality Collection; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Hospital Admissions

Children: During 2003-2007, falls followed by inanimate mechanical forces were the leading causes of injury related hospital admissions for both Any and Sole Pacific children. Transport related injuries as a group however also made a significant contribution (**Table 84**).

Young People: During 2003-2007 inanimate mechanical forces, followed by falls were the leading causes of injury related hospital admissions for Any and Sole Pacific young people. Assaults however also made a significant contribution (**Table 85**).

Table 84. Most Frequent Causes of Injury Related Hospital Admission for Pacific Children 0-14 Years, New Zealand 2003-2007

Mode of Injury	Number: Total 2001-2005	Number: Annual Average	Rate per 100,000	% of Total
Any Pacific				
Falls	2,669	533.8	543.01	39.0
Mechanical Forces: Inanimate	2,162	432.4	439.86	31.6
Mechanical Forces: Animate	254	50.8	51.68	3.7
Electricity / Fire / Burns	379	75.8	77.11	5.5
Transport: Cyclist	237	47.4	48.22	3.5
Transport: Pedestrian	207	41.4	42.11	3.0
Transport: Vehicle Occupant	123	24.6	25.02	1.8
Transport: Motorbike	15	3.0	3.05	0.2
Transport: Other Land Transport	50	10.0	10.17	0.7
Accidental Poisoning	188	37.6	38.25	2.7
Assault	138	27.6	28.08	2.0
Accidental Threat to Breathing	48	9.6	9.77	0.7
Drowning / Submersion	20	4.0	4.07	0.3
Intentional Self Harm	20	4.0	4.07	0.3
Undetermined Intent	13	2.6	2.65	0.2
Other Causes	315	63.0	64.09	4.6
Total	6,838	1,367.6	1,391.19	100.0
Sole Pacific				
Falls	1,963	392.6	781.12	38.3
Mechanical Forces: Inanimate	1,680	336.0	668.51	32.7
Mechanical Forces: Animate	192	38.4	76.40	3.7
Electricity / Fire / Burns	295	59.0	117.39	5.8
Transport: Cyclist	182	36.4	72.42	3.5
Transport: Pedestrian	176	35.2	70.03	3.4
Transport: Vehicle Occupant	91	18.2	36.21	1.8
Transport: Motorbike	8	1.6	3.18	0.2
Transport: Other Land Transport	26	5.2	10.35	0.5
Accidental Poisoning	115	23.0	45.76	2.2
Assault	94	18.8	37.40	1.8
Accidental Threat to Breathing	34	6.8	13.53	0.7
Drowning / Submersion	17	3.4	6.77	0.3
Undetermined Intent	11	2.2	4.38	0.2
Intentional Self Harm	7	1.4	2.79	0.1
Other Causes	239	47.8	95.10	4.7
Total	5,130	1,026.0	2,041.33	100.0

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Mechanical Forces: Inanimate includes being accidentally struck/crushed/injured by an object/implement. Emergency Department Admissions excluded (see Appendix 4 for rationale).

Table 85. Most Frequent Causes of Injury Related Hospital Admission for Pacific Young People 15-24 Years, New Zealand 2003-2007

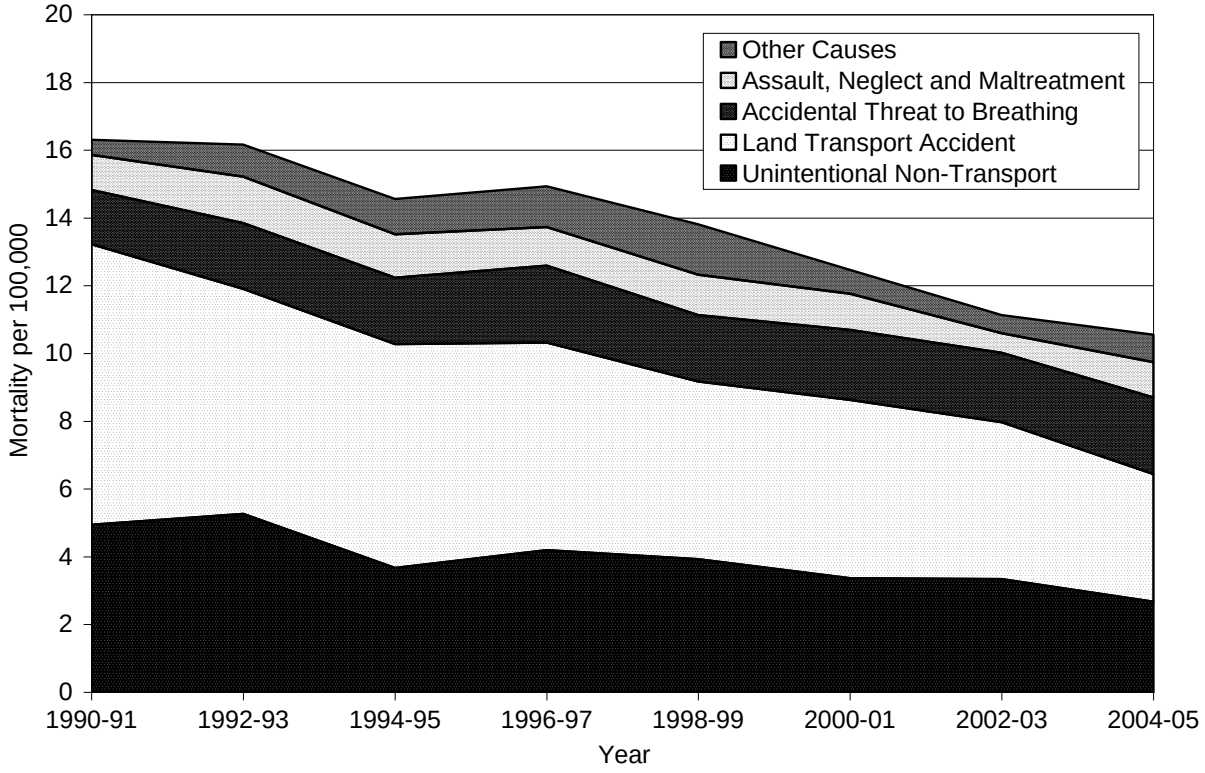
Mode of Injury	Number: Total 2001-2005	Number: Annual Average	Rate per 100,000	% of Total
Any Pacific				
Mechanical Forces: Inanimate	1,448	289.6	616.41	31.4
Mechanical Forces: Animate	334	66.8	142.18	7.2
Falls	915	183.0	389.51	19.8
Assault	689	137.8	293.31	14.9
Transport: Vehicle Occupant	374	74.8	159.21	8.1
Transport: Pedestrian	75	15.0	31.93	1.6
Transport: Cyclist	38	7.6	16.18	0.8
Transport: Motorbike	37	7.4	15.75	0.8
Transport: Other Land Transport	37	7.4	15.75	0.8
Intentional Self Harm	145	29.0	61.73	3.1
Electricity / Fire / Burns	49	9.8	20.86	1.1
Accidental Poisoning	40	8.0	17.03	0.9
Undetermined Intent	20	4.0	8.51	0.4
All Other Causes	410	82.0	174.54	8.9
Total	4,611	922.2	1,962.89	100.0
Sole Pacific				
Mechanical Forces: Inanimate	1,165	233.0	800.19	32.2
Mechanical Forces: Animate	273	54.6	187.51	7.5
Falls	744	148.8	511.02	20.5
Assault	538	107.6	369.53	14.8
Transport: Vehicle Occupant	266	53.2	182.71	7.3
Transport: Pedestrian	55	11.0	37.78	1.5
Transport: Cyclist	33	6.6	22.67	0.9
Transport: Motorbike	27	5.4	18.55	0.7
Transport: Other Land Transport	24	4.8	16.49	0.7
Intentional Self Harm	83	16.6	57.01	2.3
Electricity / Fire / Burns	39	7.8	26.79	1.1
Accidental Poisoning	28	5.6	19.23	0.8
Undetermined Intent	12	2.4	8.24	0.3
All Other Causes	336	67.2	230.79	9.3
Total	3,623	724.6	2,488.49	100.0

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Mechanical Forces: Inanimate includes being accidentally struck/crushed/injured by an object/implement. Emergency Department Admissions excluded (see Appendix 4 for rationale).

New Zealand Trends in Injury Mortality

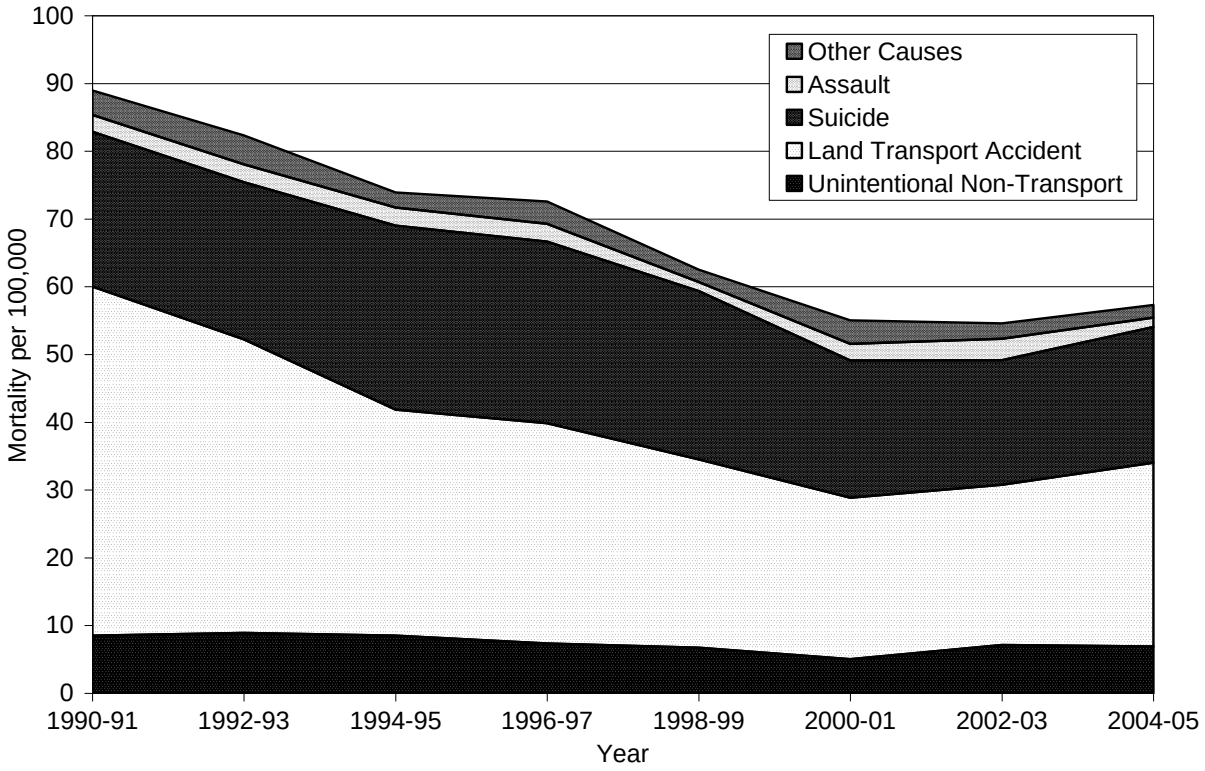
During 1990-2005, injury related mortality in New Zealand children gradually declined, with the largest absolute declines being in the land transport accident category (where rates fell from 8.3 per 100,000 in 1990-91 to 3.8 per 100,000 in 2004-05) (**Figure 110**). While injury related mortality in young people declined during 1990-2001, upswings in land transport and unintentional non-transport injury deaths during 2002-2005 resulted in a small increase in overall rates during this period (**Figure 111**).

Figure 110. Trends in Injury Mortality for Children 0-14 Years, New Zealand 1990-2005



Source: Numerator-National Mortality Collection; Denominator-Census.

Figure 111. Trends in Injury Mortality for Young People 15-24 Years, New Zealand 1990-2005



Source: Numerator-National Mortality Collection; Denominator-Census.

Unintentional Non-Transport Injuries in Children

Trends in Mortality

In New Zealand during 1990-2005, unintentional non-transport injury deaths (e.g. due to falls, mechanical forces, drowning, burns, poisoning) in children and young people gradually declined, although an upswing in rates was evident for young people (15-24 years) during 2002-2005 (**Figure 112**).

Gender and Age Differences

When broken down by age, unintentional non-transport injury admissions were lowest for those <1 year, but then rose rapidly to peak between one and two years of age. While for females, rates declined throughout childhood, for males this decline was much less marked. A similar gender imbalance was seen for mortality during the teenage years (**Figure 113**). When broken down by cause, admissions for falls peaked at 5 years, while accidental poisoning, inanimate mechanical forces and exposure to electricity / fire / burns were highest for those aged 1-2 years (**Figure 114**).

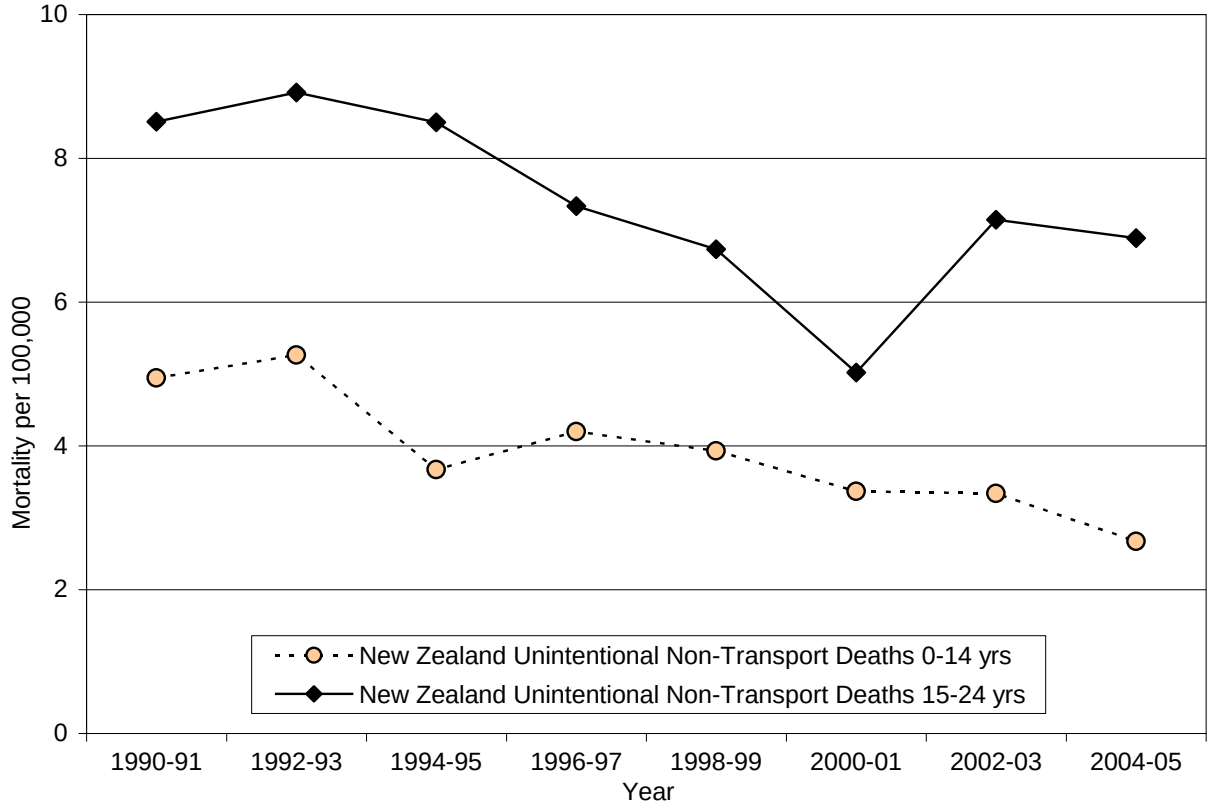
Distribution by Season

In New Zealand during 2003-2007, hospital admissions for unintentional non-transport injuries in children were generally lower in winter, although seasonal variations were less prominent in young people (**Figure 116**).

Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

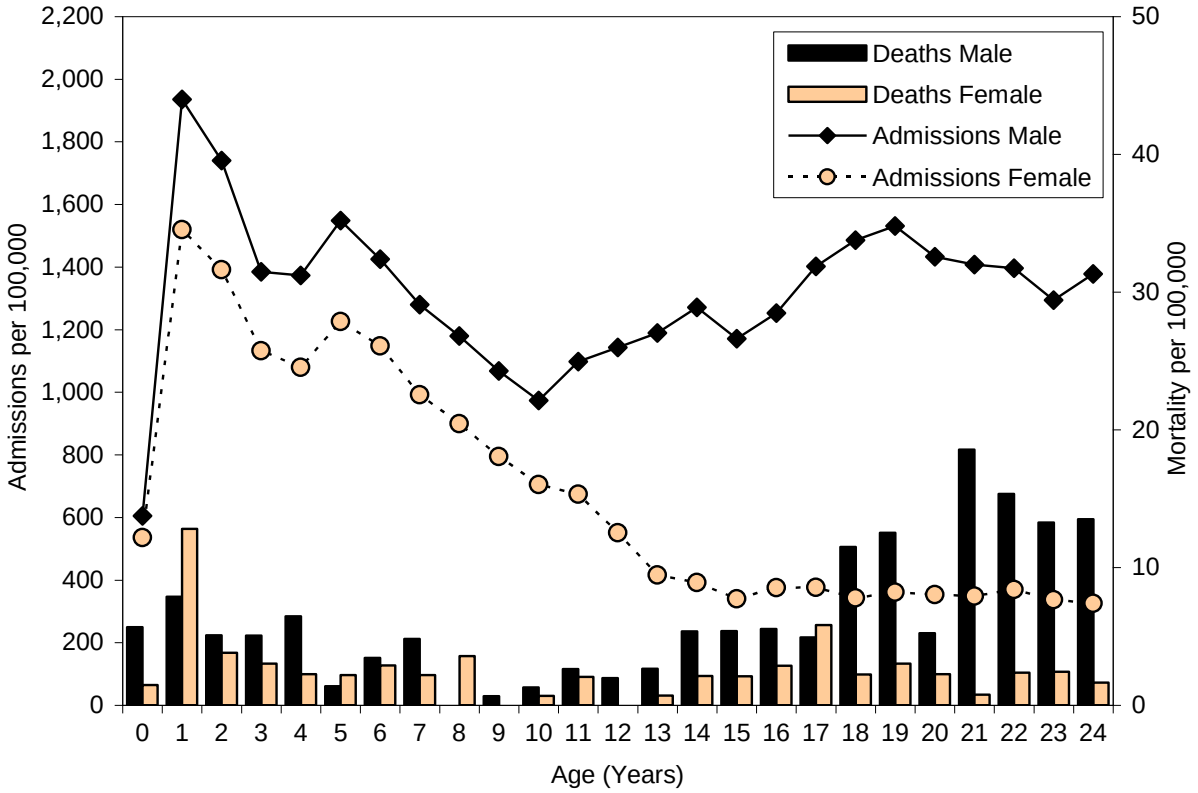
In New Zealand during 2003-2007, hospital admissions for unintentional non-transport injuries were *significantly higher* for Pacific > Māori > European > Asian children, males and those living in more deprived or urban areas (**Table 86**). For young people, admissions were *significantly higher* for Pacific > Māori > European > Asian young people, males and those living in more deprived or rural areas (**Table 87**). In contrast, during 1996-2005 mortality from unintentional non-transport injuries was generally higher for Māori children and young people, with no consistent differences being seen between Sole and Any Pacific children and young people during this period (**Figure 115**).

Figure 112. Deaths from Unintentional Non-Transport Injuries in Children 0-14 Years and Young People 15-24 Years, New Zealand 1990-2005



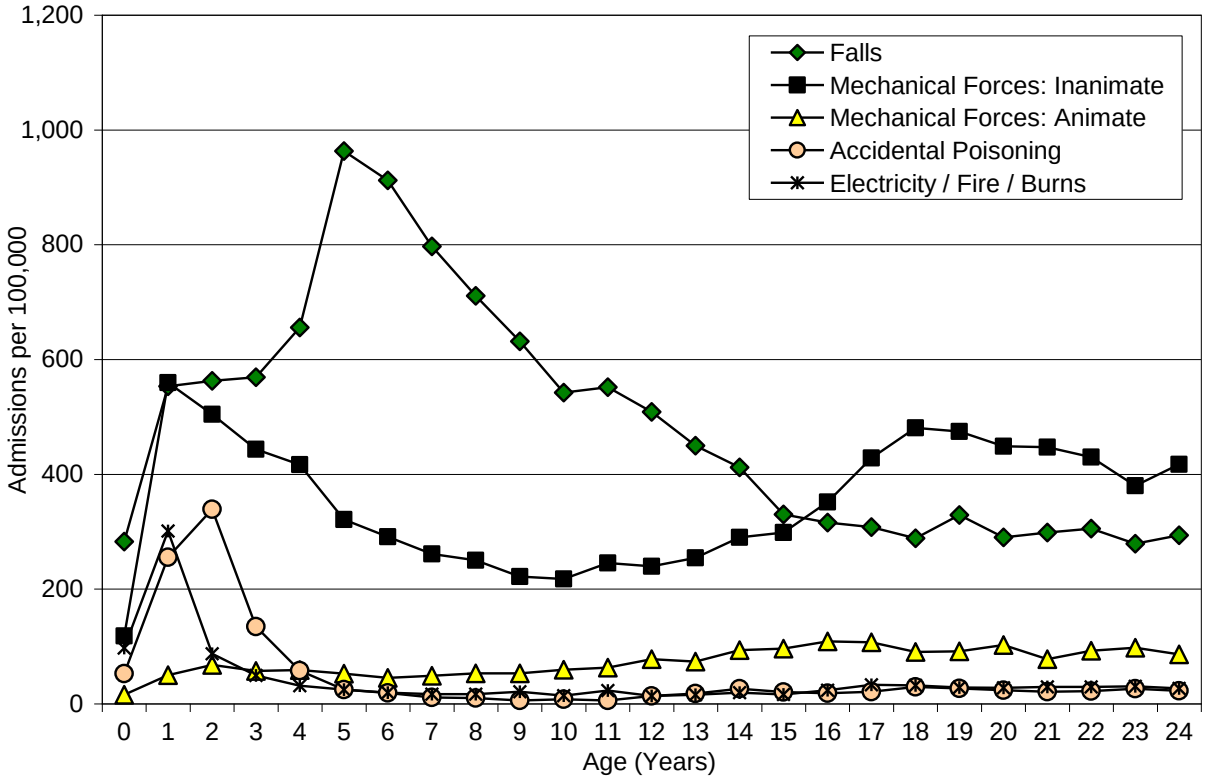
Source: Numerator-National Mortality Collection; Denominator-Census

Figure 113. Hospital Admissions (2003-07) and Deaths (2001-05) from Unintentional Non-Transport Injuries in Children and Young People 0-24 by Age and Gender, New Zealand



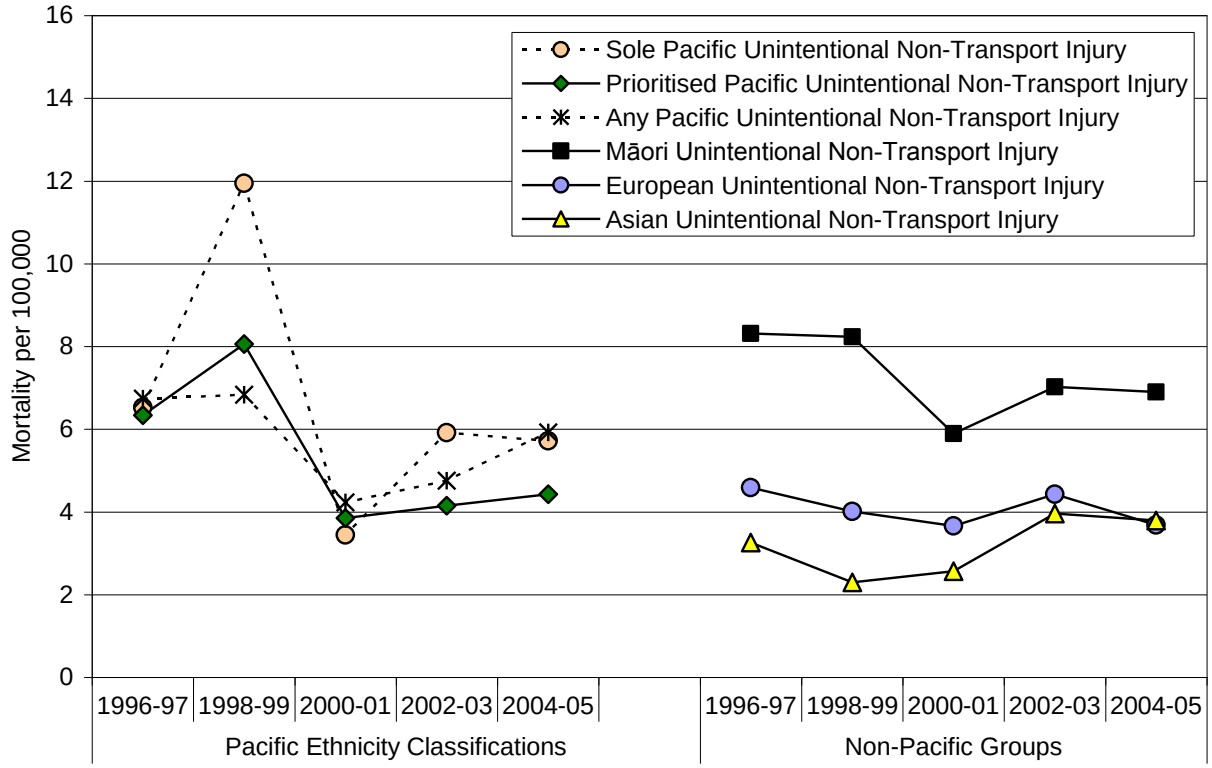
Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census.

Figure 114. Hospital Admissions for Selected Unintentional Non-Transport Injuries in Children and Young People 0-24 Years by Age and Cause, New Zealand 2003-2007



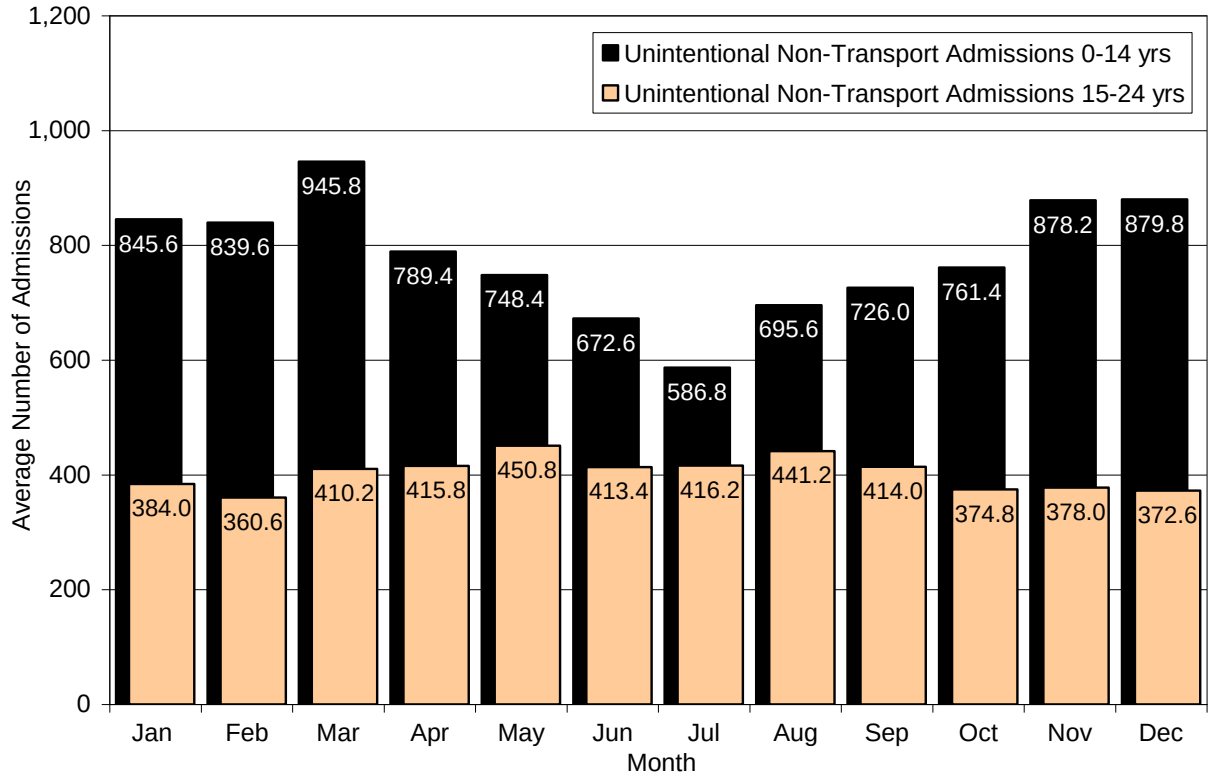
Source: Numerator-National Minimum Dataset; Denominator-Census.

Figure 115. Deaths from Unintentional Non-Transport Injuries in Children and Young People 0-24 Years by Ethnicity, New Zealand 1996-2005



Source: Numerator-National Mortality Collection; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 116. Average Number of Hospital Admissions for Unintentional Non-Transport Injuries per Month in Children (0-14 Yrs) and Young People (15-24 Yrs), New Zealand 2003-2007



Source: National Minimum Dataset

Table 86. Risk Factors for Hospital Admission due to Unintentional Non-Transport Related Injury in Children 0-14 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	771.51	1.00		1-2	756.32	1.00	
2	740.45	0.96	0.91 - 1.01	3-4	854.11	1.13	1.09 - 1.17
3	792.63	1.03	0.98 - 1.08	5-6	1003.03	1.33	1.28 - 1.37
4	916.79	1.19	1.13 - 1.24	7-8	1230.58	1.63	1.58 - 1.68
5	927.76	1.20	1.15 - 1.26	9-10	1461.44	1.93	1.88 - 1.99
6	1078.43	1.40	1.34 - 1.46	Prioritised Ethnicity			
7	1145.71	1.49	1.42 - 1.55	European	1074.54	1.00	
8	1311.54	1.70	1.63 - 1.77	Māori	1231.98	1.15	1.12 - 1.17
9	1483.52	1.92	1.85 - 2.00	Pacific	1355.77	1.26	1.22 - 1.30
10	1443.16	1.87	1.80 - 1.95	Asian	635.94	0.59	0.57 - 0.62
Gender				Urban / Rural			
Female	885.43	1.00		Urban	1127.73	1.00	
Male	1274.89	1.44	1.41 - 1.47	Rural	836.28	0.74	0.72-0.76

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted

Table 87. Risk Factors for Hospital Admission due to Unintentional Non-Transport Related Injury in Young People 15-24 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	599.71	1.00		1-2	629.72	1.00	
2	658.91	1.10	1.02 - 1.18	3-4	733.70	1.17	1.11 - 1.22
3	728.29	1.21	1.13 - 1.30	5-6	755.71	1.20	1.14 - 1.26
4	739.18	1.23	1.15 - 1.32	7-8	896.17	1.42	1.36 - 1.49
5	704.73	1.18	1.10 - 1.26	9-10	1116.75	1.77	1.70 - 1.85
6	803.49	1.34	1.25 - 1.43	Prioritised Ethnicity			
7	816.11	1.36	1.27 - 1.45	European	855.03	1.00	
8	971.98	1.62	1.52 - 1.73	Māori	1144.21	1.34	1.30 - 1.38
9	1108.65	1.85	1.74 - 1.96	Pacific	1295.94	1.52	1.45 - 1.58
10	1125.07	1.88	1.77 - 1.99	Asian	271.76	0.32	0.30 - 0.34
Gender				Urban / Rural			
Female	353.26	1.00		Urban	853.50	1.00	
Male	1372.02	3.88	3.76 - 4.01	Rural	949.05	1.11	1.07 - 1.16

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted

Hospital Admissions for Unintentional Non-Transport Injuries Amongst Pacific Groups in New Zealand

Distribution by Pacific Group

During 2003-2007 (using the Sole / Any classification), unintentional non-transport injury admissions for children in each of New Zealand's Sole Pacific groups were *significantly higher* than for non-Māori non-Pacific children. While admissions for Any Samoan, Tongan and Other Pacific children were also *significantly higher* than for non-Māori non-Pacific children, admissions for Any Cook Island Māori and Niue children were *significantly lower* (**Table 88**). Admissions for young people in each of New Zealand's Sole Pacific groups were also *significantly higher* than for non-Māori non-Pacific young people, as were admissions for Any Samoan, Tongan, Cook Island Māori, Fijian and Other Pacific young people (**Table 88**).

Table 88. Hospital Admissions for Unintentional Non-Transport Injuries in Pacific Children and Young People 0-24 Years by Pacific Group, New Zealand 2003-2007

Any Pacific										
Pacific Group	Children 0-14 Years					Young People 15-24 Years				
	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Any Samoan	2,834	566.8	1157.59	1.16	1.11-1.20	1,363	272.6	1182.45	1.56	1.47-1.65
Any Tongan	1,200	240.0	1169.15	1.17	1.10-1.24	547	109.4	1321.06	1.74	1.60-1.89
Any Cook Island Māori	1,014	202.8	865.38	0.86	0.81-0.92	449	89.8	838.33	1.10	1.01-1.21
Any Niuean	342	68.4	779.33	0.78	0.70-0.87	174	34.8	827.74	1.09	0.94-1.27
Any Fijian	174	34.8	1159.07	1.16	1.00-1.34	128	25.6	1438.04	1.89	1.59-2.25
Any Tokelauan	119	23.8	844.15	0.84	0.70-1.01	58	11.6	933.53	1.23	0.95-1.59
Any Other Pacific	200	40.0	1348.71	1.35	1.17-1.55	114	22.8	1538.46	2.03	1.69-2.43
Any Pacific	5,672	1,134.4	1153.96	1.15	1.12-1.19	2,788	557.6	1186.84	1.56	1.50-1.63
Any Māori	12,273	2,454.6	1231.98	1.23	1.21-1.26	5,685	1,137.0	1144.21	1.51	1.46-1.55
Non-Māori Non-Pacific	29,533	5,906.6	1001.08	1.00		15,904	3,180.8	759.24	1.00	

Sole Pacific										
Pacific Group	Children 0-14 Years					Young People 15-24 Years				
	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Sole Samoan	2,145	429.0	1707.26	1.71	1.63-1.78	1,126	225.2	1534.42	2.02	1.90-2.15
Sole Tongan	942	188.4	1566.08	1.56	1.47-1.67	469	93.8	1685.35	2.22	2.03-2.43
Sole Cook Island Māori	649	129.8	1544.91	1.54	1.43-1.67	311	62.2	1151.47	1.52	1.36-1.70
Sole Niuean	184	36.8	2079.10	2.08	1.80-2.40	99	19.8	1367.59	1.80	1.48-2.19
Sole Fijian	85	17.0	1813.91	1.81	1.47-2.24	86	17.2	2262.56	2.98	2.42-3.67
Sole Tokelauan	67	13.4	1811.30	1.81	1.43-2.29	38	7.6	1434.50	1.89	1.38-2.59
Sole Other Pacific	138	27.6	2211.54	2.21	1.87-2.61	87	17.4	2390.77	3.15	2.56-3.88
Sole Pacific	4,262	852.4	1695.93	1.69	1.64-1.75	2,251	450.2	1546.12	2.04	1.95-2.13
Sole Māori	9,621	1,924.2	2246.93	2.24	2.19-2.30	4,749	949.8	1914.66	2.52	2.44-2.60
Non-Māori Non-Pacific	29,533	5,906.6	1001.08	1.00		15,904	3,180.8	759.24	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); RR: Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted.

Injuries from Land Transport Accidents

Trends in Land Transport Mortality

In New Zealand during 1990-2005, land transport mortality declined in both children and young people, although there was a small upswing in mortality for young people during 2004-05 (**Figure 117**).

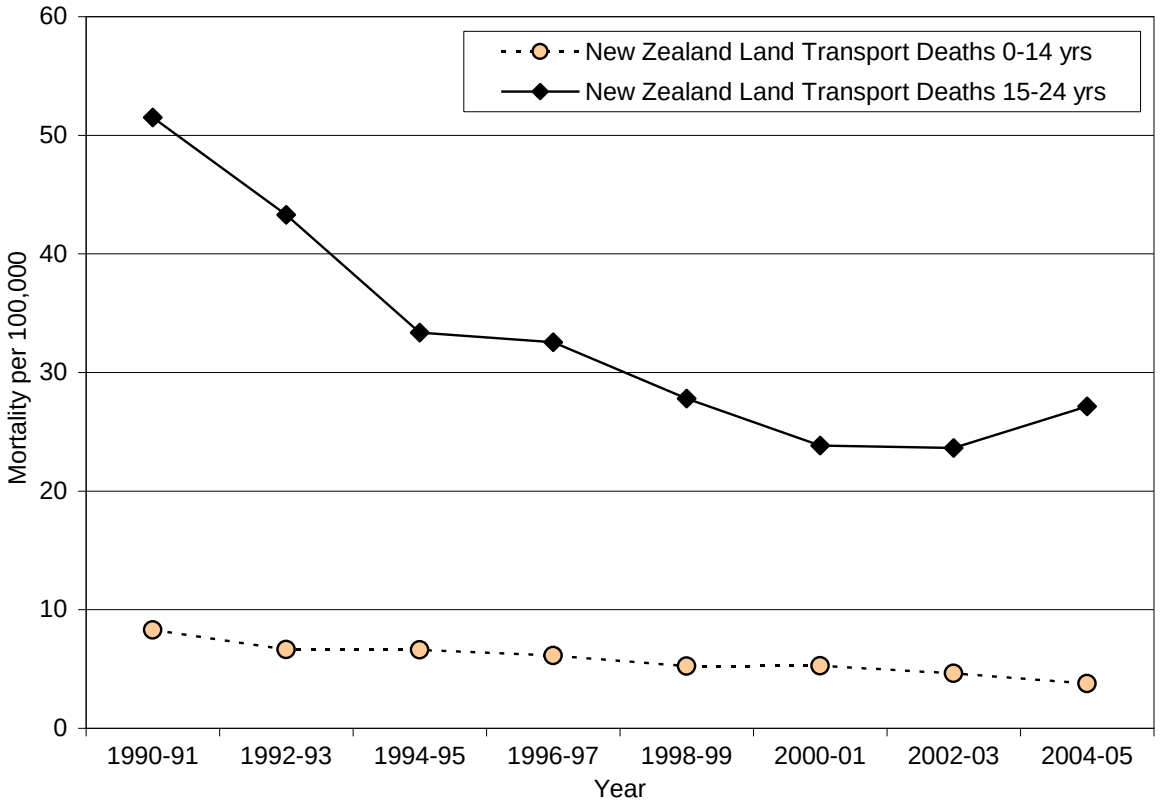
New Zealand Traffic vs. Non-Traffic Related Land Transport Admissions

In New Zealand during 2003-2007, the majority of hospital admissions for injuries sustained while children and young people were the occupants of motor vehicles were traffic related (89.9%). In contrast, only 67.4 % of pedestrian injuries, 36.8% of cyclist injuries and 36.9% of motorbike injuries were related to traffic accidents (**Table 89**).

Differences by Age, Gender and Cause

During 2003-2007, hospital admissions for land transport injuries increased with age, reaching a peak amongst those in their late teens, before declining. With the exception of the first two years of life, admissions were higher for males than females at all ages. While mortality in early-mid childhood was relatively static, rates increased rapidly thereafter, reaching a peak amongst those in their late teens. A similar male predominance in mortality was evident amongst those in their teens and early twenties (**Figure 118**). When admissions were broken down by cause, pedestrian injuries were highest for those aged 1 year, cycling injuries were highest during late childhood/early adolescence and vehicle occupant injuries were highest for those in their late teens and early twenties (**Figure 119**).

Figure 117. Deaths from Land Transport Injuries in Children 0-14 Years and Young People 15-24 Years, New Zealand 1990-2005



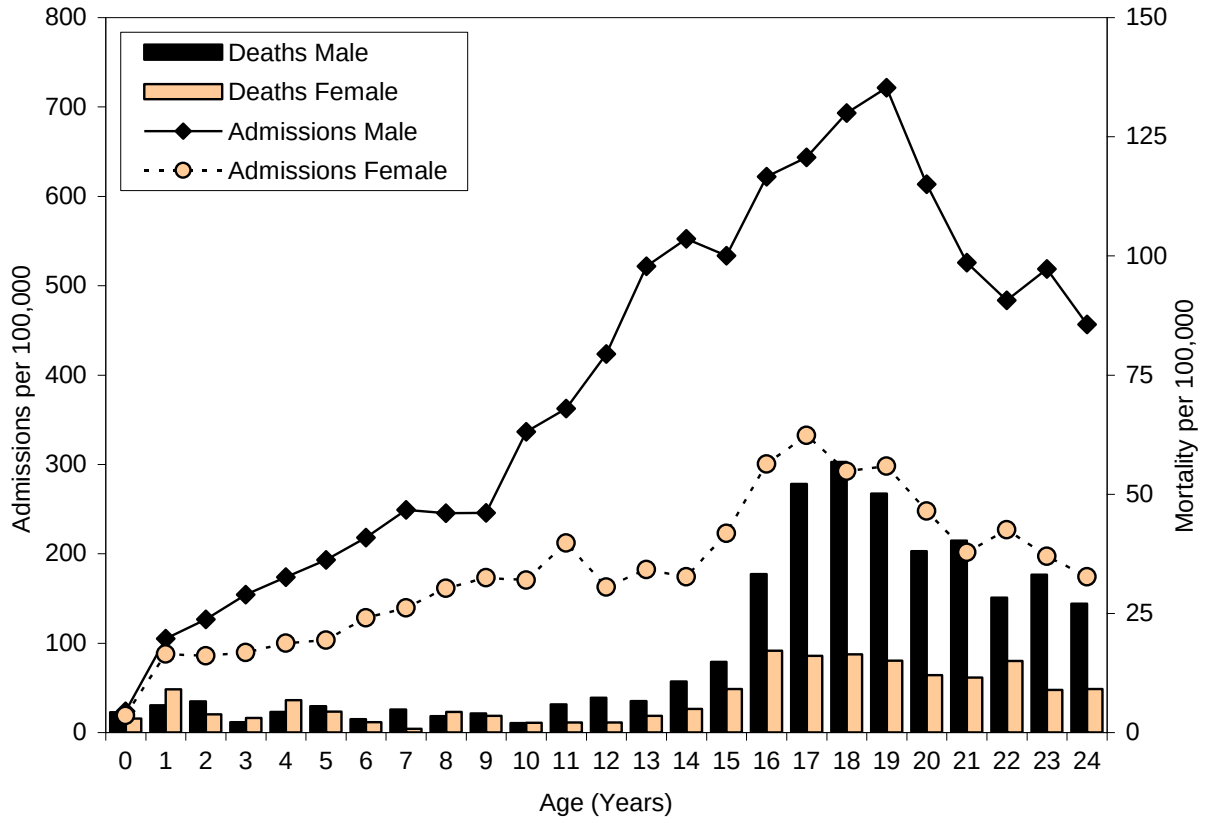
Source: Numerator-National Mortality Collection; Denominator-Census.

Table 89. Hospital Admissions for Land Transport Injuries in Children and Young People 0-24 Years by Type, New Zealand 2003-2007

Type		Boarding or Alighting	Non-Traffic Accident	Traffic Accident	Unspecified Accident	Total
Vehicle Occupant	No.	106	519	6409	96	7,130
	%	1.5	7.3	89.9	1.3	100.0
Motorbike	No.	12	2256	1377	85	3,730
	%	0.3	60.5	36.9	2.3	100.0
Cyclist	No.	8	1991	1707	935	4,641
	%	0.2	42.9	36.8	20.1	100.0
Pedestrian	No.		511	1242	89	1,842
	%	0.0	27.7	67.4	4.8	100.0
3 Wheeler	No.		7	1		8
	%	0.0	87.5	12.5	0.0	100.0
Other Land Transport	No.	8	638	330	2,098	3,074
	%	0.3	20.8	10.7	68.2	100.0
Total	No.	134	5,922	11,066	3,303	20,425
	%	0.7	29.0	54.2	16.2	100.0

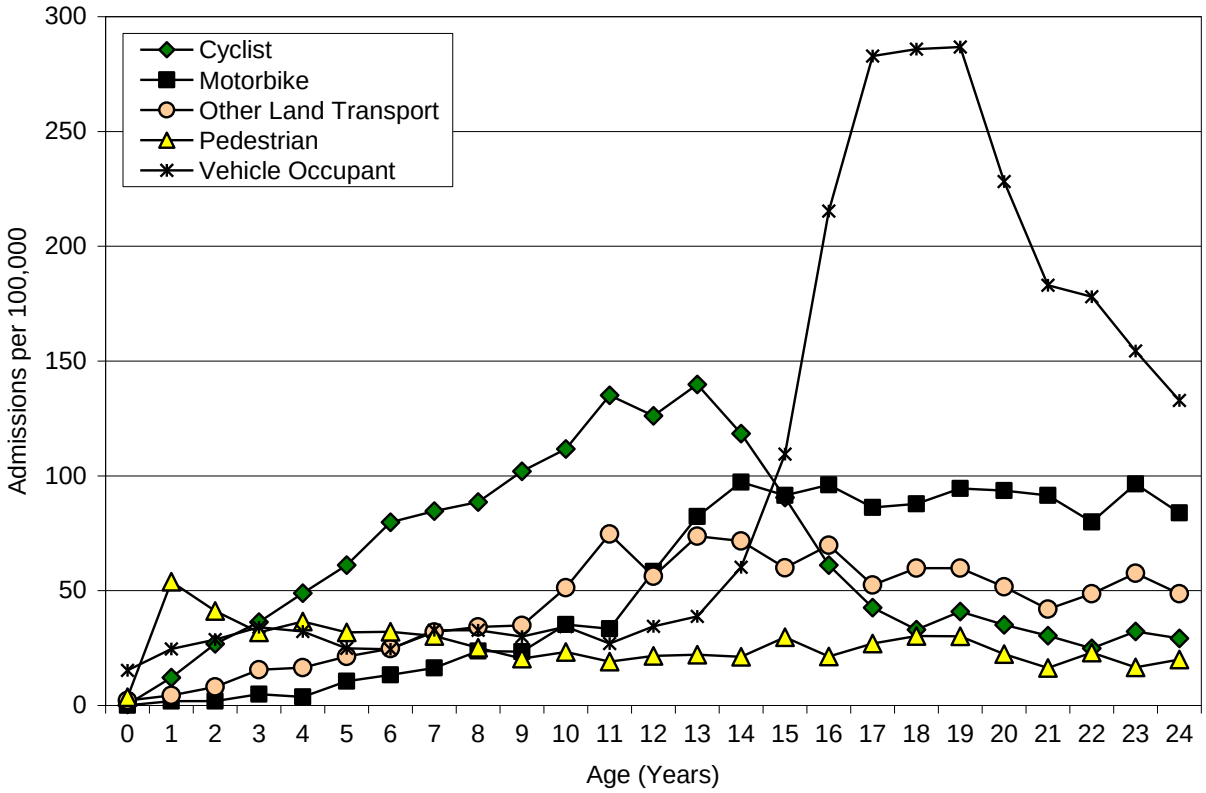
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: A 'Traffic Accident' is any vehicle accident occurring on a public road. A 'Non-Traffic Accident' is any vehicle accident occurring entirely in any place other than a public road (i.e. occurring off-road). 'Boarding of Alighting' accidents are those which occur during the process of getting on/in or off/out of a vehicle.

Figure 118. Hospital Admissions (2003-2007) and Deaths (2001-2005) due to Land Transport Injuries in New Zealand Children and Young People 0-24 Years by Age and Gender



Source: Numerators-National Minimum Dataset and Mortality Collection; Denominator-Census.

Figure 119. Hospital Admissions for Land Transport Injuries in Children and Young People 0-24 Years by Age and Type, New Zealand 2003-2007



Source: Numerator-National Minimum Dataset; Denominator-Census.

Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Distribution

In New Zealand during 2003-2007, land transport injury admissions were *significantly higher* for Māori > European > Pacific > Asian children (0-14 years) and young people (15-24 years), males and those living in more deprived or rural areas (**Table 90, Table 91**). During 1996-2005, land transport mortality was consistently higher for Māori children and young people than for Pacific, European or Asian children and young people (**Figure 120**).

Table 90. Risk Factors for Hospital Admission due to Land Transport Injuries in Children 0-14 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	138.37	1.00		1-2	143.28	1.00	
2	148.42	1.07	0.96 - 1.20	3-4	173.26	1.21	1.12 - 1.30
3	162.05	1.17	1.05 - 1.31	5-6	183.93	1.28	1.19 - 1.38
4	184.69	1.33	1.20 - 1.48	7-8	223.12	1.56	1.45 - 1.67
5	162.07	1.17	1.05 - 1.31	9-10	266.52	1.86	1.74 - 1.99
6	205.82	1.49	1.34 - 1.65	Prioritised Ethnicity			
7	218.27	1.58	1.42 - 1.75	European	211.04	1.00	
8	227.76	1.65	1.49 - 1.82	Māori	248.44	1.18	1.12 - 1.24
9	275.43	1.99	1.81 - 2.19	Pacific	151.45	0.72	0.66 - 0.78
10	259.15	1.87	1.70 - 2.06	Asian	85.61	0.41	0.36 - 0.46
Gender				Urban / Rural			
Female	134.01	1.00		Urban	190.60	1.00	
Male	267.87	2.00	1.91 - 2.09	Rural	265.86	1.39	1.32-1.47

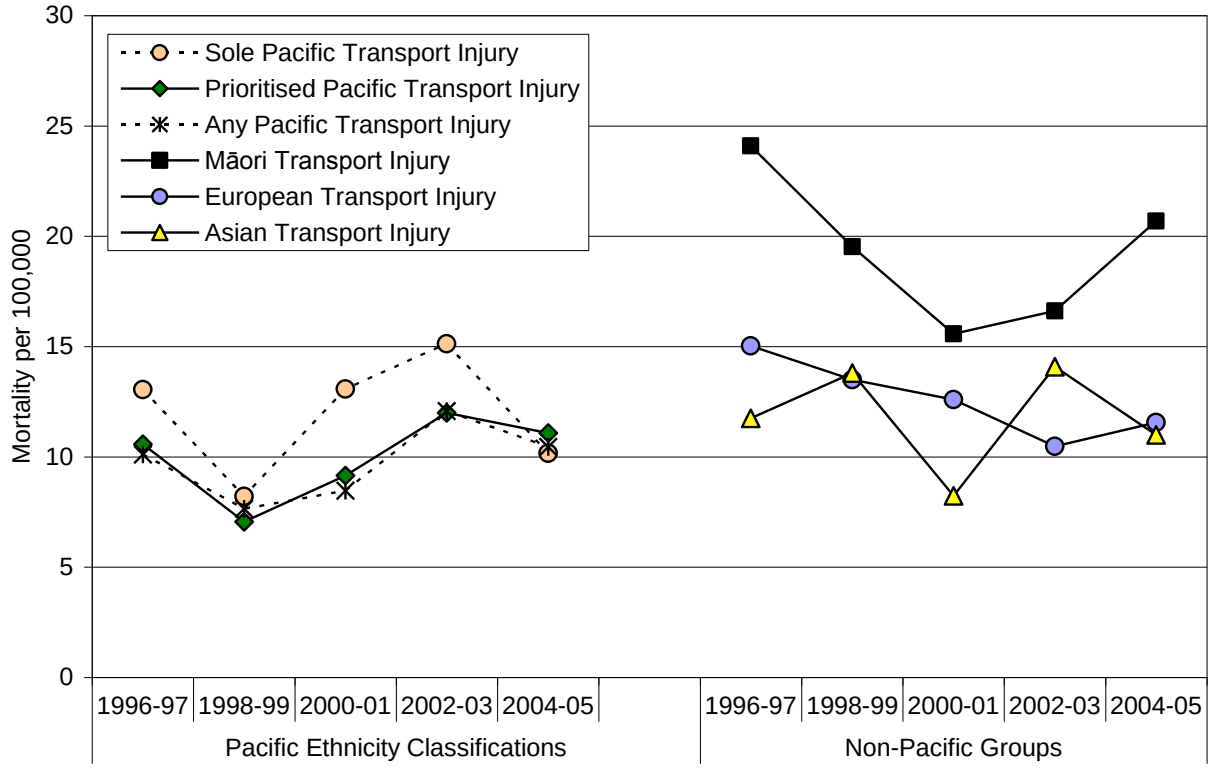
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted

Table 91. Risk Factors for Hospital Admission due to Land Transport Injuries in Young People 15-24 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	303.05	1.00		1-2	335.98	1.00	
2	367.99	1.21	1.10 - 1.34	3-4	370.04	1.10	1.03 - 1.18
3	337.57	1.11	1.01 - 1.23	5-6	399.52	1.19	1.11 - 1.27
4	402.90	1.33	1.21 - 1.46	7-8	413.41	1.23	1.16 - 1.31
5	368.70	1.22	1.10 - 1.34	9-10	486.26	1.45	1.36 - 1.54
6	428.41	1.41	1.29 - 1.55	Prioritised Ethnicity			
7	428.10	1.41	1.29 - 1.55	European	477.47	1.00	
8	399.49	1.32	1.20 - 1.45	Māori	509.21	1.07	1.02 - 1.12
9	499.28	1.65	1.51 - 1.80	Pacific	247.69	0.52	0.47 - 0.57
10	472.90	1.56	1.43 - 1.70	Asian	127.01	0.27	0.24 - 0.29
Gender				Urban / Rural			
Female	250.73	1.00		Urban	369.27	1.00	
Male	584.18	2.33	2.24 - 2.42	Rural	820.42	2.22	2.12 - 2.32

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted

Figure 120. Deaths due to Land Transport Injuries in Children and Young People 0-24 Years by Ethnicity, New Zealand 1996-2005

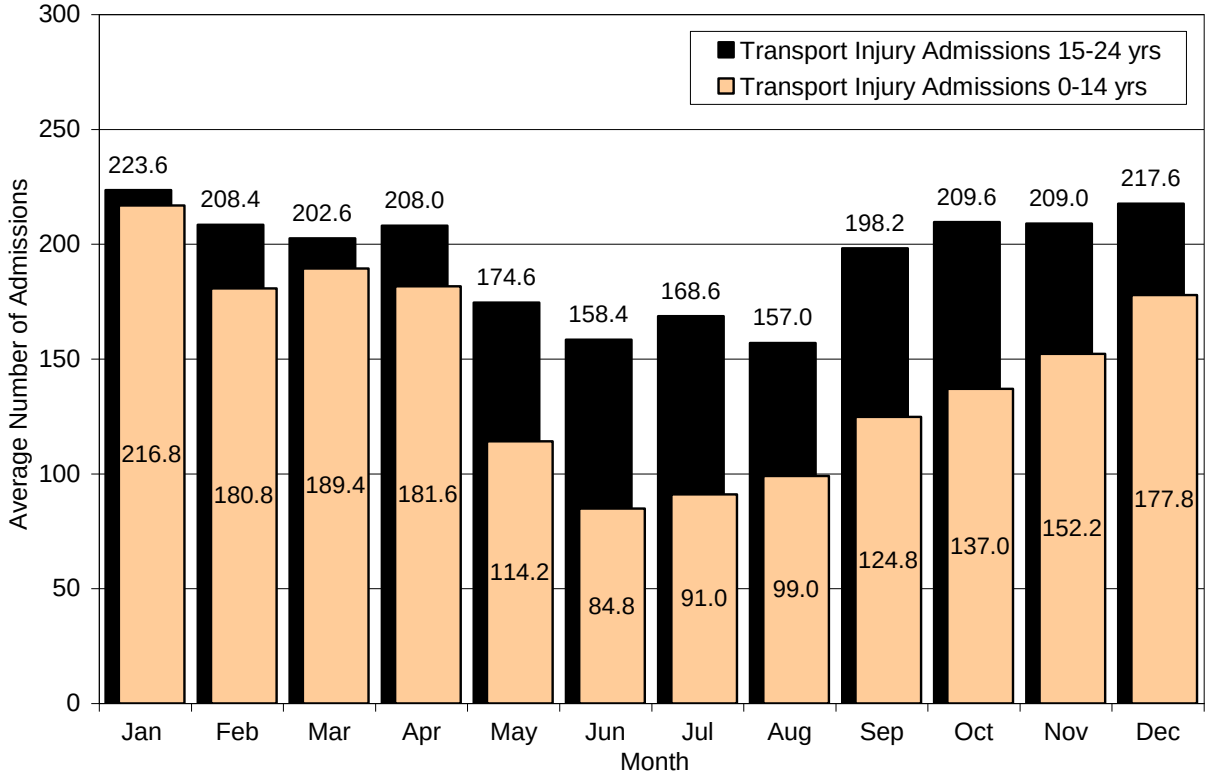


Source: Numerator-National Mortality Collection; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Distribution by Season

In New Zealand during 2003-2007, hospital admissions for Land Transport injuries were lowest during the winter months (**Figure 121**).

Figure 121. Average Number of Hospital Admissions for Land Transport Injuries per Month in Children (0-14 years) and Young People (15-24 years), New Zealand 2003-2007



Source: National Minimum Dataset

Hospital Admissions for Land Transport Injuries amongst Pacific Groups in New Zealand

Distribution by Pacific Group

During 2003-2007 (using the Sole / Any classification), hospital admissions for land transport injuries amongst Any Samoan, Tongan, Cook Island Māori and Niue children were *significantly lower* than for non-Māori non-Pacific children. In the Sole Category, admissions for children in each of New Zealand's largest Pacific groups were similar to those of non-Māori non-Pacific children, with the exception of Fijian children, where rates were *significantly higher* (small numbers prevented valid comparisons for Tokelauan children) (**Table 92**). During the same period, admissions for young people in each of New Zealand's largest Any Pacific groups (with the exception of Tokelauan and Other Pacific young people) were *significantly lower* than for non-Māori non-Pacific young people. In the Sole Category, admissions were *significantly lower* for Samoan, Tongan and Cook Island Māori young people than for non-Māori non-Pacific young people (**Table 92**).

Table 92. Hospital Admissions for Land Transport Injuries in Pacific Children and Young People 0-24 Yrs by Pacific Group, New Zealand 2003-2007

Any Pacific										
Pacific Group	Children 0-14 Years					Young People 15-24 Years				
	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Any Samoan	304	60.8	124.17	0.64	0.57-0.72	273	54.6	236.84	0.57	0.51-0.65
Any Tongan	134	26.8	130.55	0.67	0.57-0.80	87	17.4	210.11	0.51	0.41-0.63
Any Cook Island Māori	125	25.0	106.68	0.55	0.46-0.66	105	21.0	196.05	0.47	0.39-0.57
Any Niuean	30	6.0	68.36	0.35	0.25-0.51	38	7.6	180.77	0.44	0.32-0.60
Any Fijian	30	6.0	199.84	1.03	0.72-1.48	24	4.8	269.63	0.65	0.44-0.97
Any Tokelauan	<5	s	s	s	s	17	3.4	273.62	0.66	0.41-1.06
Any Other Pacific	20	4.0	134.87	0.70	0.45-1.08	32	6.4	431.85	1.04	0.74-1.48
Any Pacific	632	126.4	128.58	0.66	0.61-0.72	561	112.2	238.82	0.58	0.53-0.63
Any Māori	2,475	495.0	248.44	1.28	1.22-1.35	2,530	506.0	509.21	1.23	1.18-1.29
Non-Māori Non-Pacific	5,709	1,141.8	193.52	1.00		8,657	1,731.4	413.28	1.00	
Sole Pacific										
Pacific Group	Children 0-14 Years					Young People 15-24 Years				
	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Sole Samoan	233	46.6	185.45	0.96	0.84-1.09	203	40.6	276.63	0.67	0.58-0.77
Sole Tongan	104	20.8	172.90	0.89	0.74-1.08	67	13.4	240.76	0.58	0.46-0.74
Sole Cook Island Māori	83	16.6	197.58	1.02	0.82-1.27	67	13.4	248.07	0.60	0.47-0.76
Sole Niuean	16	3.2	180.79	0.93	0.57-1.53	21	4.2	290.10	0.70	0.46-1.08
Sole Fijian	26	5.2	554.84	2.87	1.95-4.21	12	2.4	315.71	0.76	0.43-1.34
Sole Tokelauan	<5	s	s	s	s	10	2.0	377.50	0.91	0.49-1.70
Sole Other Pacific	15	3.0	240.38	1.24	0.75-2.06	19	3.8	522.12	1.26	0.81-1.98
Sole Pacific	483	96.6	192.20	0.99	0.91-1.09	405	81.0	278.18	0.67	0.61-0.74
Sole Māori	2,032	406.4	474.56	2.45	2.33-2.58	2,111	422.2	851.09	2.06	1.96-2.16
Non-Māori Non-Pacific	5,709	1,141.8	193.52	1.00		8,657	1,731.4	413.28	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted.

Summary

All Injuries: During 2003-2007, falls followed by inanimate mechanical forces were the leading causes of injury related hospital admissions for Any and Sole Pacific children, while the order was reversed for young people. In contrast, during 2001-2005 accidental threats to breathing were the leading cause of injury related mortality for Any Pacific children although the majority of these deaths occurred in infants <1 year, raising the possibility of diagnostic transfer from the SUDI category. Pedestrian injuries were the leading cause of injury mortality for Sole Pacific children, followed by accidental threats to breathing. Intentional self harm, followed by vehicle occupant injuries were the leading causes of injury related mortality for both Any and Sole Pacific young people.

Unintentional Non-Transport Injuries: In New Zealand during 1990-2005, unintentional non-transport injury deaths in children and young people gradually declined, although an upswing in rates was evident for young people during 2002-2005. During 2003-2007, hospital admissions for unintentional non-transport injuries were *significantly higher* for Pacific > Māori > European > Asian children and young people, males and those in more deprived or urban areas. During the same period (using the Sole / Any classification), admissions for children and young people in each of New Zealand's Sole Pacific groups were *significantly higher* than for non-Māori non-Pacific children and young people. While admissions for Any Samoan, Tongan and Other Pacific children and young people and Any Cook Island Māori and Fijian young people were also *significantly higher* than for non-Māori non-Pacific children, admissions for Any Cook Island Māori and Niue children were *significantly lower*.

Land Transport Injuries: In New Zealand during 1990-2005, land transport mortality declined in both children and young people, although there was a small upswing in rates for young people during 2004-2005. During 2003-2007, land transport injury admissions were *significantly higher* for Māori > European > Pacific > Asian children and young people, males and those living in more deprived or rural areas. During the same period (using the Sole / Any classification), admissions for Any Samoan, Tongan, Cook Island Māori and Niue children were *significantly lower* than for non-Māori non-Pacific children. In contrast, admissions for children in each of the Sole Pacific groups were similar to those of non-Māori non-Pacific children, with the exception of Fijian children, where rates were *significantly higher* (small numbers prevented valid comparisons for Tokelauan children). During the same period, admissions for young people in each of the Any Pacific groups (with the exception of Tokelauan and Other Pacific young people) were *significantly lower* than for non-Māori non-Pacific young people. Admissions were also *significantly lower* for Sole Samoan, Tongan and Cook Island Māori young people.

Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Unintentional Injuries

In New Zealand, the *NZ Injury Prevention Strategy* provides broad strategic direction in the area of unintentional injury, while the *Child and Youth Health Toolkit* provides some suggestions relevant to children and young people. The multi-factorial nature of unintentional injuries, and the broad range of contexts in which they occur, however, means that a range of initiatives will be required, if injury rates are to be reduced in future years. **Table 93** provides an overview of local policy documents and evidence based reviews which consider the most effective approaches to preventing unintentional injuries in this age group.

Table 93. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Unintentional Injuries in Children and Young People

Ministry of Health Policy Documents
Ministry of Health. **The New Zealand Injury Prevention Strategy**. 2003, Ministry of Health: Wellington. http://nzips.govt.nz/strategy/index.php. This strategy outlines a vision of a 'safe New Zealand, becoming injury free" with two goals of achieving a positive safety culture and creating safe environments. The strategy outlines 10 objectives and 11 underlying principles. It also identifies six priority areas which include motor vehicle crashes, suicide and deliberate self harm, falls, workplace injuries, assault and drowning / near drowning.
Ministry of Health. **Child and Youth Health Toolkit.** 2004, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/pagesmh/5411/$File/childandyouthhealthtoolkit.pdf This toolkit is aimed at District Health Board (DHB) staff and others wishing to improve child and youth health. It contains a section on injury which outlines a range of strategies DHBs might use to address the issue of childhood injury in their regions.
Systematic and Other Reviews from the International Literature
Kendrick D, Coupland C, Mulvaney C, et al. **Home Safety Education and Provision of Safety Equipment for Injury Prevention.** Cochrane Database of Systematic Reviews 2007, Issue 1. Home safety education (provided most commonly as one-to-one, face-to-face education in a clinical setting or at home (especially with the provision of safety equipment)) is effective in increasing a range of safety practices. However there is a lack of evidence regarding its impact on child injury rates. There was no consistent evidence that home safety education (with or without the provision of safety equipment) was less effective in those at greater risk of injury.
Kendrick D, Barlow J, Hampshire A, et al. **Parenting Interventions for the Prevention of Unintentional Injuries in Childhood.** Cochrane Injuries Group Cochrane Database of Systematic Reviews. 2007, Issue 4. This review found that parenting interventions (most commonly provided in the home using multi-faceted interventions), may be effective in reducing child injury. The evidence relates mainly to interventions provided to families at risk of adverse child health outcomes. The authors suggest further research is needed to explore the mechanisms by which these interventions reduce injury, the features of parenting interventions that are necessary or sufficient to reduce injury, and their generalisability to different groups.
Ehiri J, Ejere H, Magnussen L, et al. **Interventions for Promoting Booster Seat Use in Four To Eight Year Olds Travelling in Motor Vehicles**. Cochrane Injuries Group Cochrane Database of Systematic Reviews. 2006, Issue 1. This review found that interventions to increase the use of booster seats among children aged 4-8 years are effective. Combining incentives (booster seat discount coupons or gift certificates) or free booster seats with education demonstrated marked beneficial outcomes for acquisition and use of booster seats for 4-8 year olds. There is some evidence of beneficial effects of legislation on acquisition and use of booster seats but this was mainly from uncontrolled before-and-after studies, which did not meet the criteria for inclusion in this meta-analysis.
Lyons R, Sander L, Weightman A, et al. **Modification of the Home Environment for the Reduction of Injuries**. Update in Cochrane Database Systematic Reviews. 2006, Issue 4. This review considered the effectiveness of modifying the home environment (with a primary focus on interventions to reduce physical hazards), on injuries. The authors found insufficient evidence to determine the effectiveness of such interventions and recommended further research (using large adequately designed randomised controlled trials) to assess their impact on injury outcomes.
Kwan I, Mapstone J. **Interventions for Increasing Pedestrian and Cyclist Visibility for the Prevention of Death and Injuries.** Cochrane Injuries Group Cochrane Database of Systematic Reviews. 2006, Issue 4. This review considered randomised controlled trials which explored the effectiveness of visibility aids for protecting pedestrians and cyclists. The authors found no studies comparing the number of crashes, but 37 studies comparing driver detection of people with / without visibility aids. These studies showed that fluorescent materials in yellow, red and orange improved driver detection during the day; while lamps, flashing lights and retroreflective materials in red and yellow or in a 'biomotion' configuration helped at night. Although these measures help drivers see pedestrians and cyclists, more research is needed to determine whether they actually prevent deaths and serious injuries.
Guide to Community Preventive Services: Systematic Reviews and Evidence Based Recommendations: **Motor Vehicle Occupant Injury Prevention.** 2005. http://www.thecommunityguide.org/mvoi/mvoi.pdf

Towner E, Dowswell T, Mackereth C, Jarvis S. **What Works in Preventing Unintentional Injuries in Children and Young Adolescents**. 2002, Health Development Agency. http://www.nice.org.uk/nicemedia/documents/prevent_injuries.pdf

This is an updated systematic review of 155 published interventions involving children aged 0-14 years, which were either designed to prevent accidents or to reduce their impact. All included outcome measures (e.g. changes in mortality or morbidity, changes in observed or reported behaviour).

Spinks A, Turner C, Nixon J, McClure R. **The 'WHO Safe Communities' Model for the Prevention of Injury in Whole Populations**. Cochrane Injuries Group Cochrane Database of Systematic Reviews. 2005, Issue 2.

Over 80 communities worldwide have been designated as WHO 'Safe Communities', with programmes which target high-risk groups or environments. Such programmes include bicycle helmet promotion in Sweden, anti-violence programmes in South Africa, traffic safety initiatives in South Korea, and indigenous community injury prevention in New Zealand. Only 7 “Safe Communities” from two geographical regions have undertaken controlled evaluations: the Scandinavian countries of Sweden and Norway and the Pacific nations of Australia and New Zealand. Overall, results were positive with Safe Communities in Sweden and Norway seeing reductions in injury rates, suggesting the model is effective in reducing injuries in whole populations. Australian and New Zealand communities were less successful (although shorter lengths of follow up may have contributed). Limited information is available on programme implementation, impact on injury risk factors, or sustainability and some also had methodological limitations.

Royal ST, Kendrick D, Coleman T. **Non- Legislative Interventions for the Promotion of Cycle Helmet Wearing By Children.** Cochrane Injuries Group Cochrane Database of Systematic Reviews. 2005, Issue 2.

This review focused on encouraging children to wear helmets, as distinct from compelling them to do so by legislation. The reviewers considered the effectiveness of different campaigns, particularly for children from poor families, who are less likely to own helmets. Overall, 22 helmet promotion campaigns were studied, which varied widely with regard to location, age of children and campaign methodology. While results also varied, overall after a campaign, children were more likely to wear helmets. While further research is still needed, the best schemes were based in the community or schools and involved both education and providing free / subsidised helmets. (Note: The reviewers were unable to identify the best way of reaching poorer children and did not explore the impact of campaigns on injury rates, or assess whether the campaigns had any negative effects).

Turner C, Spinks A, McClure R, Nixon J. **Community-Based Interventions for the Prevention of Burns and Scalds in Children.** Cochrane Database of Systematic Reviews 2004, Issue 2.

While multi-strategy, community-based interventions are widely promoted for reducing injury rates, the efficacy of these approaches is difficult to assess as there have been few research studies of good quality. This review considered studies which evaluated the effectiveness of community-based programmes to reduce burn and scald injury in children. Only 4 studies were identified that met inclusion criteria, of which 2 found a reduction in rates of burns and scalding. The authors concluded there was insufficient evidence at present to support community approaches to burns and scalds prevention and suggested further high-quality research studies were needed to support the continued use of community approaches.

Towner E, Dowswell T, Errington G, et al. **Injuries in Children Aged 0-14 Years And Inequalities**.2004, Health Development Agency. http://www.nice.org.uk/nicemedia/pdf/_injuries_in_children_inequalities.pdf.

Injury mortality and morbidity among children aged 0-14 varies substantially depending on the child's age, gender, socio-economic group, cultural and/or ethnic group, and where they live. This report describes and seeks to understand these variations and explains why each factor is associated with injury risk. It then highlights how a range of intervention studies have attempted to address these inequalities.

Bunn F, Collier T, Frost C, et al. **Area-Wide Traffic Calming for Preventing Traffic Related Injuries**. Cochrane Injuries Group Cochrane Database of Systematic Reviews. 2003, Issue 1.

In high-income countries, traffic calming schemes aim to make the roads safer (particularly for vulnerable road users such as pedestrians and cyclists) in areas that are not particular 'hot spots'. Strategies include slowing down traffic (e.g. speed humps, mini-roundabouts), visual changes (road surface treatment, changes to road lighting), redistributing traffic (blocking roads, creating one-way streets), and/or changes to road environments (e.g. trees). The review found that area-wide traffic calming has the potential to reduce death and injuries, but more research is needed particularly in low and middle income countries.

Guide to Community Preventive Services: Systematic Reviews and Evidence Based Recommendations: **Effectiveness of Community-Wide Information and Enhanced Campaigns to Increase Child Safety Seat Use.** 2002. http://www.thecommunityguide.org/mvoi/mvoi-child-seat-enforce.pdf

Duperrex O, Roberts I, Bunn F. **Safety Education of Pedestrians for Injury Prevention**. Cochrane Database of Systematic Reviews 2002, Issue 2.

A large proportion of those killed or seriously injured in road traffic crashes are pedestrians, and children are particularly vulnerable. This review of trials (mostly in children) found that pedestrian safety education can improve children's road safety knowledge and their observed road crossing behaviour. Education may need to be repeated at regular intervals, as the effect can decline with time. However, whether these changes to knowledge or behaviour can be linked to a reduction in pedestrian deaths and injuries is unknown.

DiGuiseppi C, Goss C, Higgins J. **Interventions for Promoting Smoke Alarm Ownership and Function**. Cochrane Injuries Group Cochrane Database of Systematic Reviews. 2001, Issue 2.

This review found that programmes to promote smoke alarms increased smoke alarm ownership and function modestly, if at all, and have not demonstrated a beneficial effect on fires or fire-related injuries. Counselling by health care workers, as part of child health care, may increase ownership and use of smoke alarms in homes but effects on injuries have not been examined. There is little evidence to support community-wide mass media or educational programmes or programmes to give away free smoke alarms as effective methods to promote smoke alarms or reduce injuries from fire. More research is needed to examine community-wide smoke alarm installation programmes.

Klassen T, MacKay J, Moher D, et al. **Community-Based Injury Prevention Interventions**. Future of Children, 2000. 10(1):83-110.

This review considered the effectiveness of a range of community based interventions and found that some had been successful in childhood injury prevention (e.g. the increased use of bicycle helmets, motor vehicle safety seats among children). For other injury areas the benefit of community-based strategies was less evident (e.g. child pedestrian safety, adolescent alcohol use and vehicle safety, general safety campaigns). The lack of success in these areas may be attributed to poorly designed or implemented programmes, inadequate research methodology, or the inherent inability of community-based strategies to alter safety practices, or reduce injury outcomes.

Warda L, Tenenbein M, Moffatt M. **House Fire Injury Prevention Update. Part II. A Review of the Effectiveness of Preventive Interventions.** Injury Prevention, 1999. 5(3):217-25.

This review suggests encouraging the use of fire fighters and burn unit nurses in school-based fire injury prevention education programmes, as well as focusing on a single, simple message (e.g. purchasing and installing a smoke detector), rather than addressing multiple hazards (which may be overwhelming). Periodic repetition of material is required for maintaining knowledge and skills. In addition, smoke detector giveaway programmes in high-risk areas must be followed up by long-term maintenance and inspection programmes. Finally, in order to ensure that fire prevention regulations and legislation are effective, a coordinated approach involving government, law enforcement and dedicated community members is required.

Thompson D, Rivara F. **Pool Fencing for Preventing Drowning In Children**. *Cochrane Database of Systematic Reviews* 1998, Issue 1.

In most industrialised countries, drowning is one of the top killers of children, especially young children. Medical care offers little to help drowning victims, and thus survival must rely on prevention of drowning. The review found no trials of pool fencing. However evidence from other studies found that pool fencing that adequately prevents children reaching the pool unsupervised can prevent about 3/4 of all child drownings in pools. Fencing which completely encircles the pool and isolates it from the house is much more effective than methods where children can still gain access to the pool through the house.

NHS Centre for Reviews and Dissemination. **Preventing Unintentional Injuries in Children and Young Adolescents**. Effective Health Care, 1996. 2 (5). http://www.york.ac.uk/inst/crd/pdf/ehc25.pdf

This review found good evidence for the use of cycle helmets and child car seat restraints in reducing serious injury to children involved in road traffic accidents. Urban road safety measures (e.g. the provision of crossing patrollers, measures to redistribute traffic) can reduce the rate and severity of childhood accidents. The use of safety devices in the home (e.g. smoke detectors, child resistant containers, thermostat control for tap water) can reduce the risks of home injuries. Targeting of households at higher risk combined with home visits, education and the free distribution of devices is likely to make the most impact. Educational programmes by themselves appear to have little effect. However, a number of community programmes which involve local participation and use a broad range of interventions have been effective at reducing childhood injuries from several causes. These need to be based on accurate data derived from surveillance systems.

Forthcoming Publications

Preventing Accidental Injuries Among Children, Accidental Injuries in the Home-Children Under 15 and Accidental Injuries on the Road-Children Under 15 are three public health guidance documents that are currently being developed by the National Institute for Health and Clinical Excellence. http://www.nice.org.uk/guidance/index.jsp?action=byID&o=11882

Å Oral Health: School Dental Service Data and Dental Admissions

Introduction

Dental caries are among the leading causes of arranged and waiting list hospitalisations for New Zealand children [88], and are considered by the Ministry of Health to be ambulatory sensitive [250], on the basis that early and effective management in the community (e.g. fluoridation, fluoride toothpastes, clinical application of fluoride and fissure sealants, health promotion, health education, and regular dental care) may prevent a large number of admissions for dental caries each year [171].

In New Zealand up until the early 1990s, dental caries rates amongst children were gradually declining, although in more recent years rates have become static or even increased slightly. In addition, large ethnic, socioeconomic and regional differences have remained, with Māori and Pacific children and those living in socioeconomic disadvantage being consistently more likely to experience poorer oral health outcomes [251]. In terms of known risk factors, a range of dietary (e.g. high sugar intake, fruit juice at bedtime), oral hygiene (e.g. frequency of tooth brushing, use of fluoride toothpastes) and other factors (e.g. lack of breastfeeding, presence of *Strep. Mutans*) have been shown to predispose to dental caries in a number of studies [252]. In contrast, water fluoridation has been shown to reduce dental caries by up to 50%, and to be effective in reducing socioeconomic and ethnic disparities in dental caries [253].

In New Zealand the School Dental Service (established in 1921), is charged with providing basic preventative and restorative dental care for preschool, primary and intermediate aged school children, via its team of dental therapists. While enrolment of preschool children was only 56% in 1997, enrolment of school age children is high (>95%) [253]. Children are seen annually, unless deemed to be at high risk, when 6-monthly visits are indicated. Children requiring dental care beyond the scope of the School Dental Service may be referred to a general dental practitioner, or if they require extensive treatment, to a hospital dental unit for treatment under general anaesthetic [251]. After Year 8 (Form 2), adolescents are eligible for dental care under the General Dental Benefit system up until the age of 18 years, with care being provided by private dentists working under contract with local DHBs [253].

The National Child Nutrition Survey however noted that Pacific and Māori children were significantly less likely to attend dental services (e.g. the school dental clinic or dentist) than European children, with these associations persisting after household socioeconomic factors were taken into account [254]. In addition, the Pacific Island's Family Study noted that amongst a cohort of 1,048 4 year old Pacific children born in 2000, 47% brushed their teeth ≤1/day, 47% had no adult supervision with brushing, 57% routinely snacked or drunk immediately prior to bed and 26% were yet to receive their first dental check up. Of the mothers interviewed, 34% brushed their teeth ≤1/day and 50% had never seen, or had last visited a dentist >5 years ago. The authors concluded that many mothers and their Pacific children had poor basic oral hygiene and dietary practices that increased oral health risk, and that culturally appropriate and targeted strategies need to be widely promoted, so that the oral health status of Pacific children might be improved [255].

The following section explores the distribution of dental caries amongst Pacific children and Young People in New Zealand using information from two different sources: School Dental Service Data (% of children caries free at 5 years and mean DMFT Scores at 12 years); and the National Minimum Dataset (hospital admissions for dental caries in children aged 0-4 years (the current ASH Target age bracket), 5-12 years (School Dental Service age-bracket) and 13-18 years (Dental Benefit Scheme age-bracket).

Data Sources and Methods

School Dental Service Data

Definition

1. Percentage of Children Caries Free at 5 years
2. Mean DMFT Score at 12 Years (Year 8)
3. Proportion of 5 year old and Year 8 children who completed dental treatment

Data Sources

1. Percentage of Children Caries Free at 5 Years

Numerator: Total number of children aged 5 years whose deciduous teeth are caries free on completion of treatment with the School Dental Service

Denominator: Total number of 5 year olds who completed treatment with the School Dental Service

2. Mean DMFT Scores at 12 Years (Year 8)

Numerator: Total number of permanent teeth of children aged around 12 years that are decayed, missing (due to caries) or filled on completion of treatment in Year 8 prior to leaving the School Dental Service

Denominator: Total number of Year 8 children completing treatment with the School Dental Service

3. Proportion of 5 and 12 Year Old Children who Completed Treatment

Numerator: Number of 5 year old children who completed treatment prior to turning 6 years old, and the number of Year 8 children (aged ~12 years) that completed treatment in Year 8

Denominator: Number of 5 and 12 year old children at the 2006 Census.

Notes on Interpretation

Note 1: The oral health data in this section were obtained from the Ministry of Health, who collate information from the School Dental Service. Once children are enrolled with the Dental Service they are seen, assessed and have appropriate treatment prescribed. Upon completion of the set treatment, dental health status data is collected on 5 year olds and children in Year 8 (aged approximately 12 years). Therefore, unless treatment is completed prior to a child turning 6 years old, or prior to discharge from the Dental Service in Year 8, a child's dental status is not captured in this data. In regions where the proportion completing treatment is less than 100%, it is thus likely that *the oral health status of children is worse than that reported because children with no dental caries will have data* collected on assessment. Note: In this section, fluoridation status refers to the water supply of the school which the student attended, rather than the fluoridation status of the area in which they resided.

Note 2: Tests of statistical significance have not been applied to the data in this section, and thus any associations described do not imply statistical significance or non-significance.

Note 3: School Dental Services use the ethnicity information entered on each child's school record by school staff using the Ministry of Education categories (Māori, Pacific, and Other), with recent reports suggesting that the validity of this information may be unclear [256].

Indicator Category Ideal C

Hospital Admissions for the Treatment of Dental Conditions

Definition

1. Hospital Admissions for the Treatment of Dental Conditions in Children Aged 0-4 Years and 5-12 Years and Young People Aged 13-18 Years

Data Source

Admissions Numerator: National Minimum Dataset: Hospital admissions for children and young people aged 0-18 years with a primary diagnosis in the following ICD-10 range: Disorders Tooth Development / Eruption (K00); Embedded / Impacted Teeth (K01); Dental Caries (K02); Other Diseases Teeth Hard Tissue (K03); Diseases Pulp / Periapical Tissue (K04); Gingivitis / Peridontal Diseases (K05); Other Disorders Gingiva / Edentulous Alveolar Ridge (K06); Dentofacial Anomalies / Malocclusion (K07); Other Disorders Teeth / Supporting Structures (K08).

Denominator: NZ Census

Notes on Interpretation

Note 1: The coding for dental conditions in this section differs somewhat from the Ambulatory Sensitive algorithm in that a number of the conditions listed above (e.g. disorders of tooth development, dentofacial anomalies) may not be prevented by early management in the ambulatory care setting (i.e. they may require admission for procedures under general anaesthetic). In contrast, it is likely that many dental caries admissions might have been prevented given early access to preventative dental care in the ambulatory care setting.

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category Proxy B

School Dental Service Data

Fluoridation Status

During 2006, School Dental Service data indicate that 85.9% of Pacific children aged 5 years had access to fluoridated water. This information is based on the fluoridation status of the child's school however, rather than the area in which they lived.

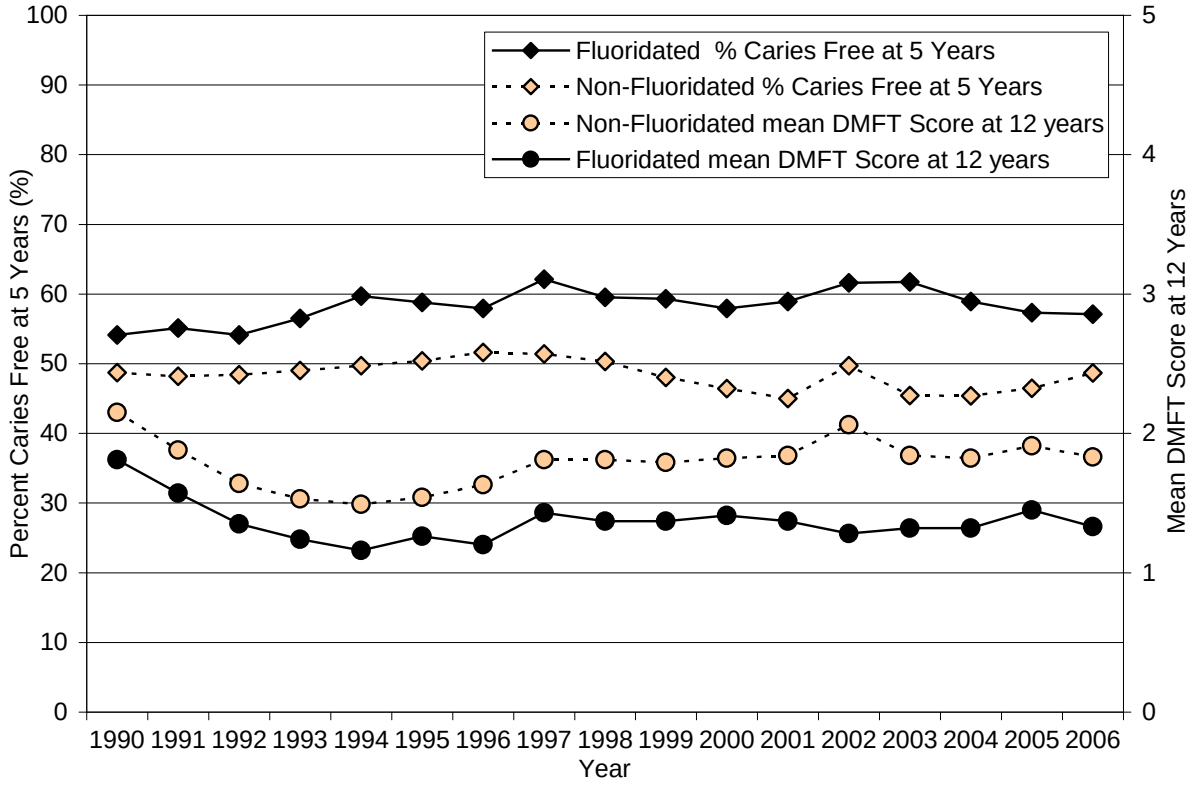
New Zealand Trends

During 1990-2006, the percentage children who were caries free at 5 years in fluoridated areas was consistently higher than for those in non-fluoridated areas, while mean DMFT scores at 12 years were consistently lower (**Figure 122**).

During 2004-2006, a lower proportion of Pacific and Māori children were caries free at 5 years, in both fluoridated and non-fluoridated areas. Māori and Pacific children also had higher mean DMFT scores at 12 years, in both fluoridated and non-fluoridated areas (**Figure 123**).

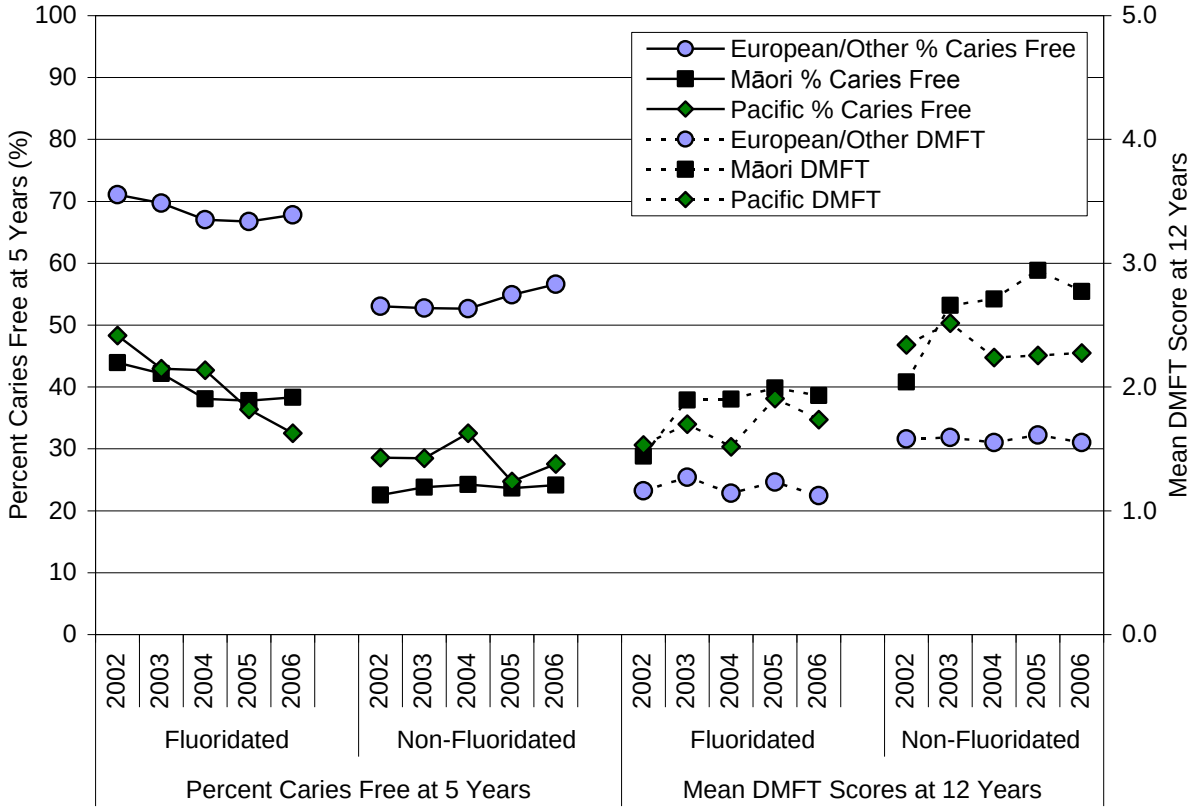
However, only children who have been assessed, completed treatment, and who are still 5 yrs or 12 years of age at the end of their treatment contribute data to this analysis. During 2002-2006, dental data coverage in New Zealand varied by ethnicity, with higher coverage being achieved for European > Māori > Pacific children. Thus trends in oral health status for Pacific children during this period must be interpreted with this in mind (e.g. some of the deterioration in the proportion of Pacific children caries free at 5 years might potentially be explained by increasing coverage (i.e. a higher proportion of children receiving treatment for dental caries completing treatment by 5 years and thus being included in oral health data at this age group)) (**Figure 124**).

Figure 122. Percentage of Children Caries Free at 5 Years and Mean DMFT Scores at 12 Years by School Water Fluoridation Status, New Zealand 1990-2006



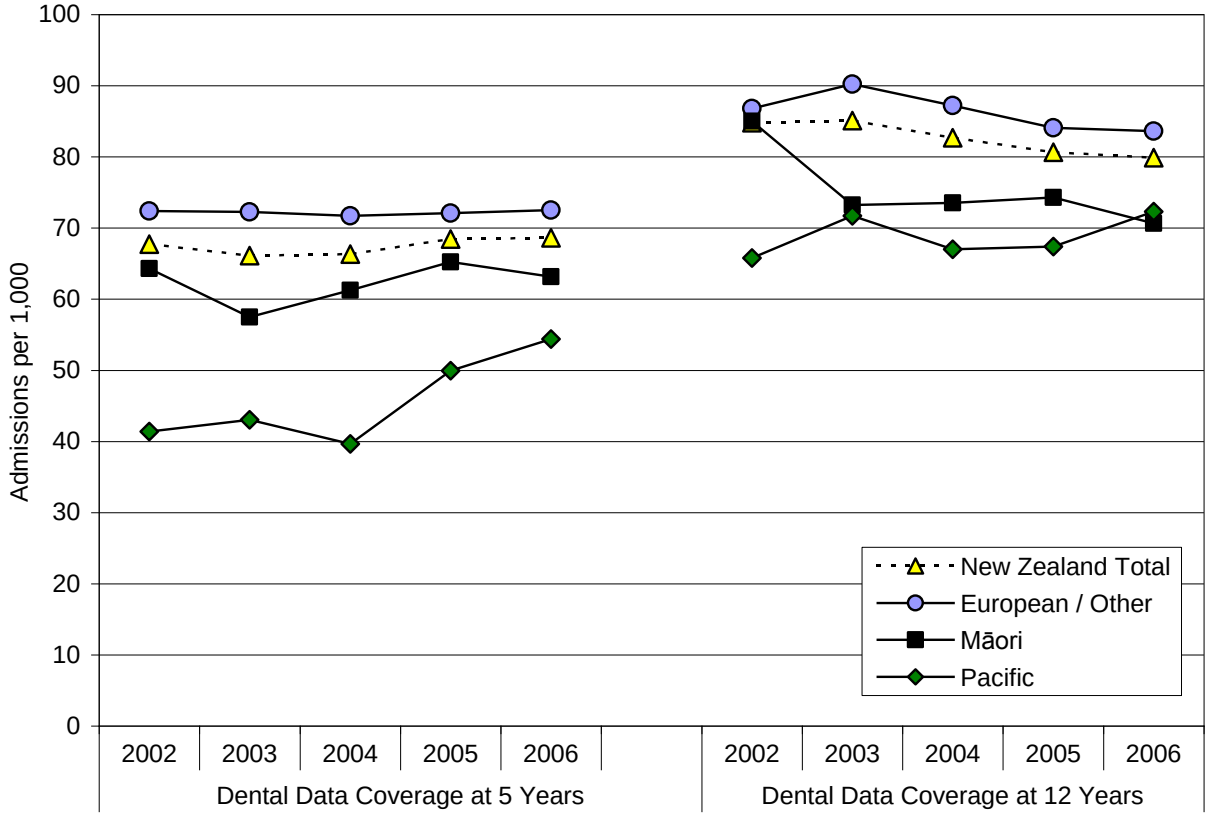
Source: School Dental Service Data.

Figure 123. Percentage of Children Caries Free at 5 Years and Mean DMFT Scores at 12 Years by Ethnicity and School Water Fluoridation Status, New Zealand 2004-2006



Source: School Dental Service Data. Note: Ethnicity classification described in Methods Section.

Figure 124. Proportion of Children Aged 5 and 12 Years who Completed Treatment and Contributed Oral Health Data by Ethnicity, New Zealand 2002-2006



Source: Numerator- School Dental Service Data; Denominator- Census. Note: Ethnicity classification described in Methods Section.

Hospital Admissions for Dental Caries

Dental Admissions by Primary Diagnosis

In New Zealand during 2003-2007, dental caries were the leading cause of dental admissions for Sole and Any Pacific children and young people. Amongst preschool (0-4 years) and school (5-14 years) age children, diseases of the pulp / periapical tissue were the second most frequent cause of dental admission, while embedded / impacted teeth made a significant contribution in young people (13-18 years) (**Table 95**). A similar pattern was seen for New Zealand as a whole (**Table 94**).

Table 94. Hospital Admissions for Dental Conditions by Primary Diagnosis in Children and Young People 0-18 Years, New Zealand 2003-2007

Primary Diagnosis	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	% of Total
0-4 Years				
Dental Caries	11,136	2,227.2	8.12	88.7
Diseases Pulp/Periapical Tissue	1,141	228.2	0.83	9.1
Disorders Tooth Development/Eruption	111	22.2	0.08	0.9
Dentofacial Anomalies/Malocclusion	58	11.6	0.04	0.5
Gingivitis/Peridontal Diseases	51	10.2	0.04	0.4
Other Dental Conditions	59	11.8	0.04	0.5
Total	12,556	2,511.2	9.16	100.0
5-12 Years				
Dental Caries	13,169	2,633.8	5.64	79.8
Diseases Pulp/Periapical Tissue	1,768	353.6	0.76	10.7
Disorders Tooth Development/Eruption	881	176.2	0.38	5.3
Embedded/Impacted Teeth	276	55.2	0.12	1.7
Dentofacial Anomalies/Malocclusion	155	31.0	0.07	0.9
Other Dental Conditions	255	51.0	0.11	1.5
Total	16,504	3,300.8	7.07	100.0
13-18 Years				
Dental Caries	979	195.8	0.54	36.8
Embedded/Impacted Teeth	712	142.4	0.40	26.8
Disorders Tooth Development/Eruption	342	68.4	0.19	12.9
Dentofacial Anomalies/Malocclusion	289	57.8	0.16	10.9
Diseases Pulp/Periapical Tissue	129	25.8	0.07	4.9
Other Dental Conditions	208	41.6	0.12	7.8
Total	2,659	531.8	1.48	100.0

Source: Numerator-National Minimum Dataset; Denominator-Census.

New Zealand Trends

In New Zealand during 1990-2007, admissions for dental caries increased markedly for preschool (0-4 years) and school age (5-12 years) children. While admissions for young people (13-18 years) doubled during this period, the rate of increase was much less marked than for younger age groups (**Figure 125**).

New Zealand Distribution by Age

In New Zealand during 2003-2007, admissions for dental caries were relatively rare under 2 years of age. Admissions increased rapidly thereafter, reached a peak at 4 years, and then declined again (**Figure 126**).

Table 95. Hospital Admissions for Dental Conditions in Pacific Children and Young People 0-18 Yrs by Primary Diagnosis, New Zealand 2003-2007

Primary Diagnosis	Any Pacific				Sole Pacific			
	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	% of Total	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	% of Total
0-4 Years								
Dental Caries	2,209	441.8	12.83	88.2	1,559	311.8	19.67	88.1
Diseases Pulp/Periapical Tissue	275	55.0	1.60	11.0	200	40.0	2.52	11.3
Disorders Tooth Development/Eruption	12	2.4	0.07	0.5	10	2.0	0.13	0.6
Other Dental Conditions	8	1.6	0.05	0.3	<5	s	s	s
Total	2,504	500.8	14.54	100.0	1,770	354.0	22.33	100.0
5-12 Years								
Dental Caries	1,788	357.6	6.89	81.7	1,323	264.6	9.61	83.7
Diseases Pulp/Periapical Tissue	295	59.0	1.14	13.5	192	38.4	1.39	12.1
Disorders Tooth Development/Eruption	59	11.8	0.23	2.7	31	6.2	0.23	2.0
Embedded/Impacted Teeth	21	4.2	0.08	1.0	16	3.2	0.12	1.0
Gingivitis/Peridontal Diseases	10	2.0	0.04	0.5	6	1.2	0.04	0.4
Other Dental Conditions	16	3.2	0.06	0.7	13	2.6	0.09	0.8
Total	2,189	437.8	8.44	100.0	1,581	316.2	11.48	100.0
13-18 Years								
Dental Caries	56	11.2	0.33	40.9	46	9.2	0.46	46.0
Embedded/Impacted Teeth	28	5.6	0.17	20.4	16	3.2	0.16	16.0
Disorders Tooth Development/Eruption	17	3.4	0.10	12.4	14	2.8	0.14	14.0
Diseases Pulp/Periapical Tissue	10	2.0	0.06	7.3	8	1.6	0.08	8.0
Gingivitis/Peridontal Diseases	6	1.2	0.04	4.4	<5	s	s	s
Other Dental Conditions	20	4.0	0.12	14.6	13	2.6	0.13	13.0
Total	137	27.4	0.81	100.0	100	20.0	1.00	100.0

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); s: small numbers preclude rate calculation.

Figure 125. Hospital Admissions for Dental Caries in Children and Young People 0-18 Years by Age, New Zealand 1990-2007

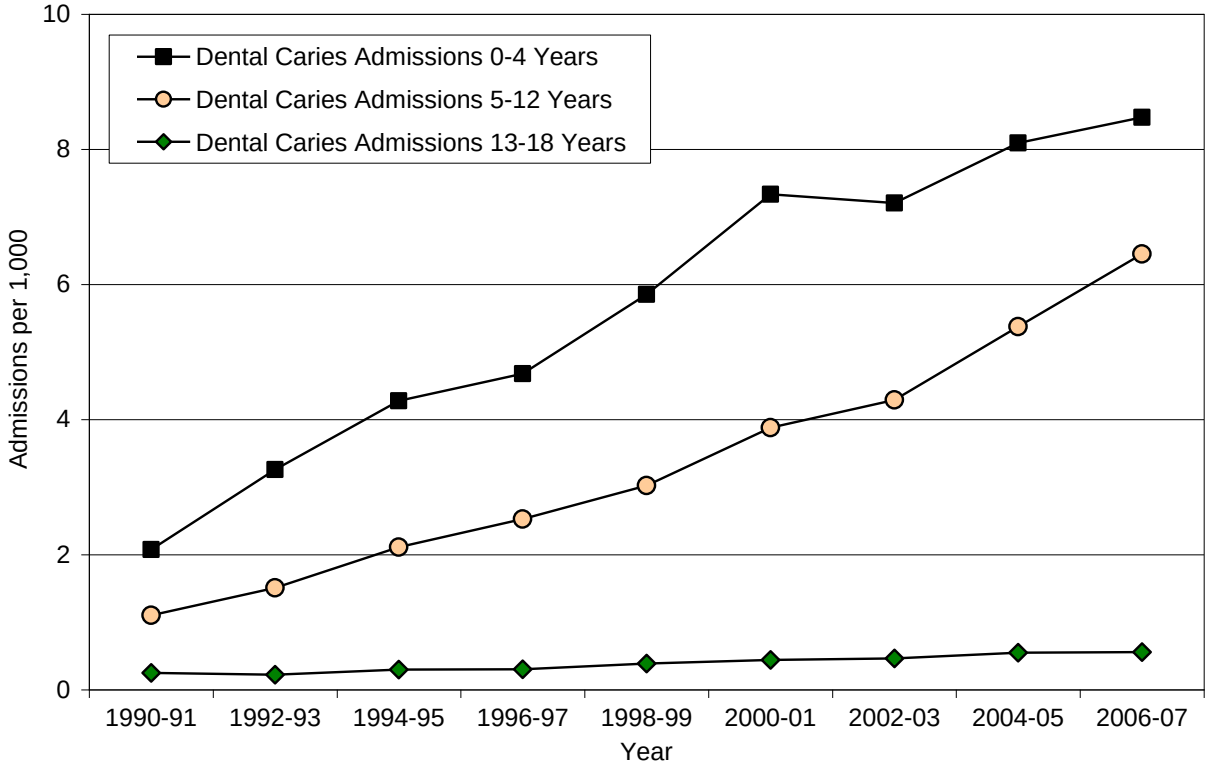
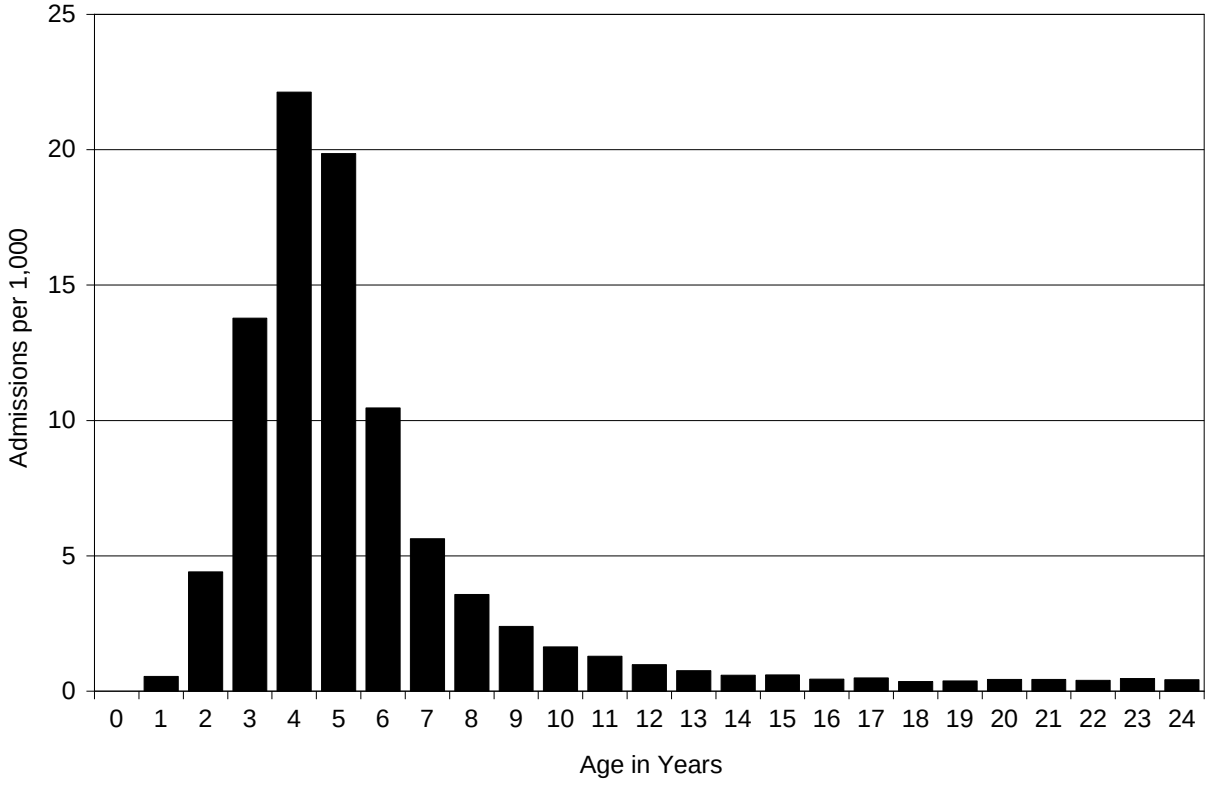


Figure 126. Hospital Admissions for Dental Caries in Children and Young People 0-24 Years by Age, New Zealand 1990-2007



Source: Numerator-National Minimum Dataset; Denominator-Census

Table 96. Risk Factors for Hospital Admissions for Dental Caries in Children and Young People 0-18 Years by Age Group, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
0-4 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	3.10	1.00		1-2	3.43	1.00	
2	3.77	1.22	1.06 - 1.39	3-4	4.94	1.44	1.32 - 1.57
3	4.22	1.36	1.19 - 1.55	5-6	6.66	1.94	1.79 - 2.10
4	5.66	1.83	1.62 - 2.06	7-8	9.82	2.86	2.65 - 3.09
5	6.12	1.97	1.75 - 2.22	9-10	13.66	3.98	3.70 - 4.27
6	7.19	2.32	2.06 - 2.60	Prioritised Ethnicity			
7	8.18	2.64	2.35 - 2.96	European	5.13	1.00	
8	11.34	3.65	3.28 - 4.08	Māori	12.58	2.45	2.35 - 2.56
9	12.23	3.94	3.54 - 4.39	Pacific	15.28	2.98	2.82 - 3.15
10	14.82	4.78	4.30 - 5.30	Asian	8.85	1.73	1.61 - 1.86
Gender				Urban / Rural			
Female	7.98	1.00		Urban	8.28	1.00	
Male	8.25	1.03	1.00 - 1.07	Rural	7.14	0.86	0.82-0.91
5-12 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	2.78	1.00		1-2	2.95	1.00	
2	3.14	1.13	1.02 - 1.25	3-4	3.99	1.35	1.26 - 1.45
3	3.47	1.25	1.13 - 1.39	5-6	5.21	1.77	1.65 - 1.89
4	4.52	1.63	1.48 - 1.79	7-8	6.87	2.33	2.18 - 2.48
5	4.68	1.69	1.53 - 1.86	9-10	8.69	2.94	2.77 - 3.12
6	5.75	2.07	1.89 - 2.27	Prioritised Ethnicity			
7	6.07	2.19	1.99 - 2.40	European	4.53	1.00	
8	7.63	2.75	2.52 - 3.00	Māori	7.87	1.74	1.67 - 1.81
9	8.81	3.17	2.91 - 3.45	Pacific	7.88	1.74	1.65 - 1.84
10	8.59	3.09	2.84 - 3.36	Asian	5.16	1.14	1.06 - 1.22
Gender				Urban / Rural			
Female	5.49	1.00		Urban	5.88	1.00	
Male	5.79	1.05	1.02-1.09	Rural	4.34	0.74	0.70-0.78
13-18 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	0.28	1.00		1-2	0.29	1.00	
2	0.29	1.03	0.71 - 1.51	3-4	0.43	1.51	1.18 - 1.94
3	0.37	1.31	0.92 - 1.88	5-6	0.55	1.92	1.51 - 2.43
4	0.50	1.77	1.26 - 2.49	7-8	0.75	2.62	2.09 - 3.28
5	0.52	1.85	1.32 - 2.60	9-10	0.69	2.41	1.93 - 3.01
6	0.58	2.04	1.46 - 2.85	Prioritised Ethnicity			
7	0.75	2.64	1.91 - 3.63	European	0.62	1.00	
8	0.76	2.68	1.95 - 3.68	Māori	0.52	0.83	0.71 - 0.98
9	0.79	2.79	2.05 - 3.81	Pacific	0.37	0.59	0.45 - 0.79
10	0.60	2.13	1.55 - 2.93	Asian	0.23	0.37	0.27 - 0.52
Gender				Urban / Rural			
Female	0.52	1.00		Urban	0.55	1.00	
Male	0.57	1.11	0.98 - 1.25	Rural	0.54	0.98	0.82-1.18

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Rate per 1,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Location

In New Zealand during 2003-2007, admissions for dental caries were *significantly higher* for Pacific > Māori > Asian > European preschool children (0-4years) and those living in more deprived or urban areas. For primary school age (5-12 years) children, dental caries admissions were *significantly higher* for Pacific and Māori > Asian > European children, males and those living in more deprived or urban areas. In contrast, for young people (13-18 years) dental caries admissions were *significantly higher* for European > Māori and Pacific > Asian young people, and those living in more deprived areas (**Table 96**).

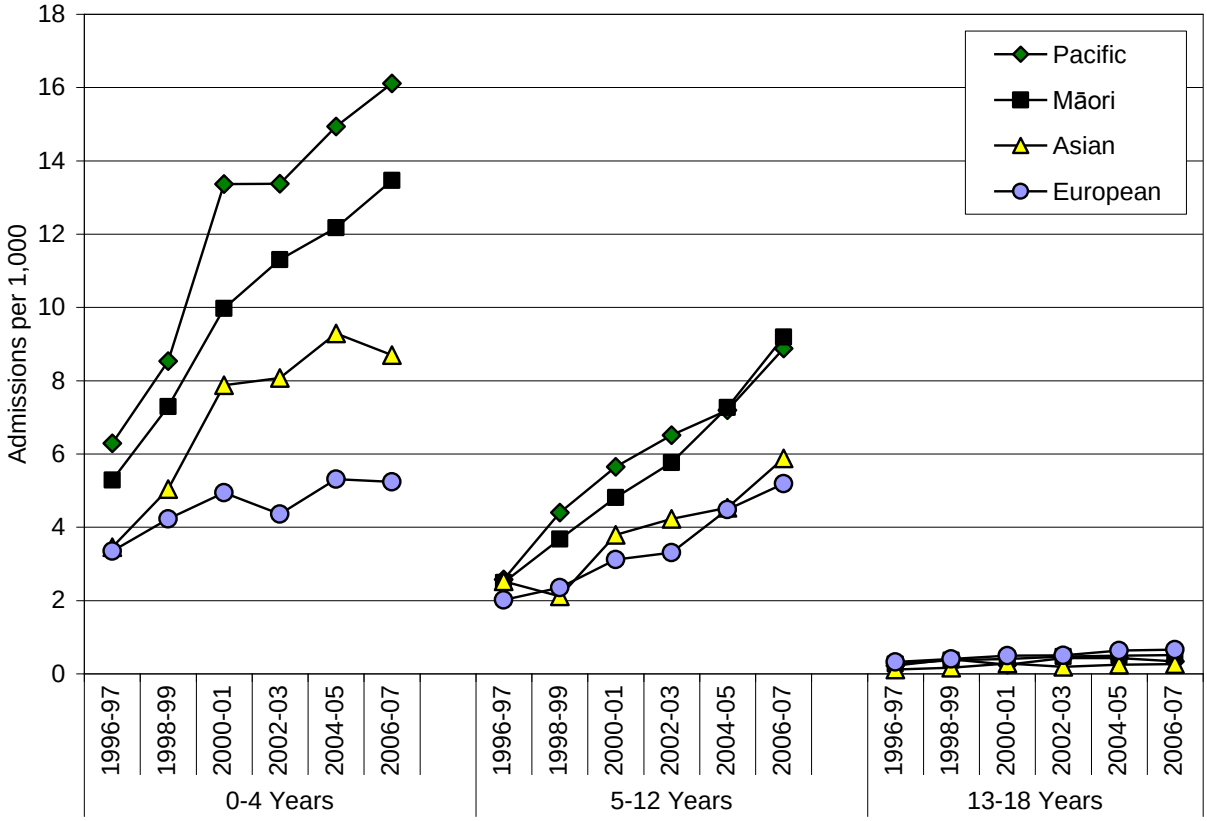
New Zealand Ethnic Specific Trends

During 1996-2007, dental caries admissions were generally higher for Pacific > Māori > Asian > European preschool age children, for Pacific and Māori > Asian and European primary school age children, and for European > Māori, Pacific and Asian young people (**Figure 127**). In addition, admissions in all three age groups were consistently higher for Sole than for Any Pacific children and young people (**Figure 128**).

Distribution by Season

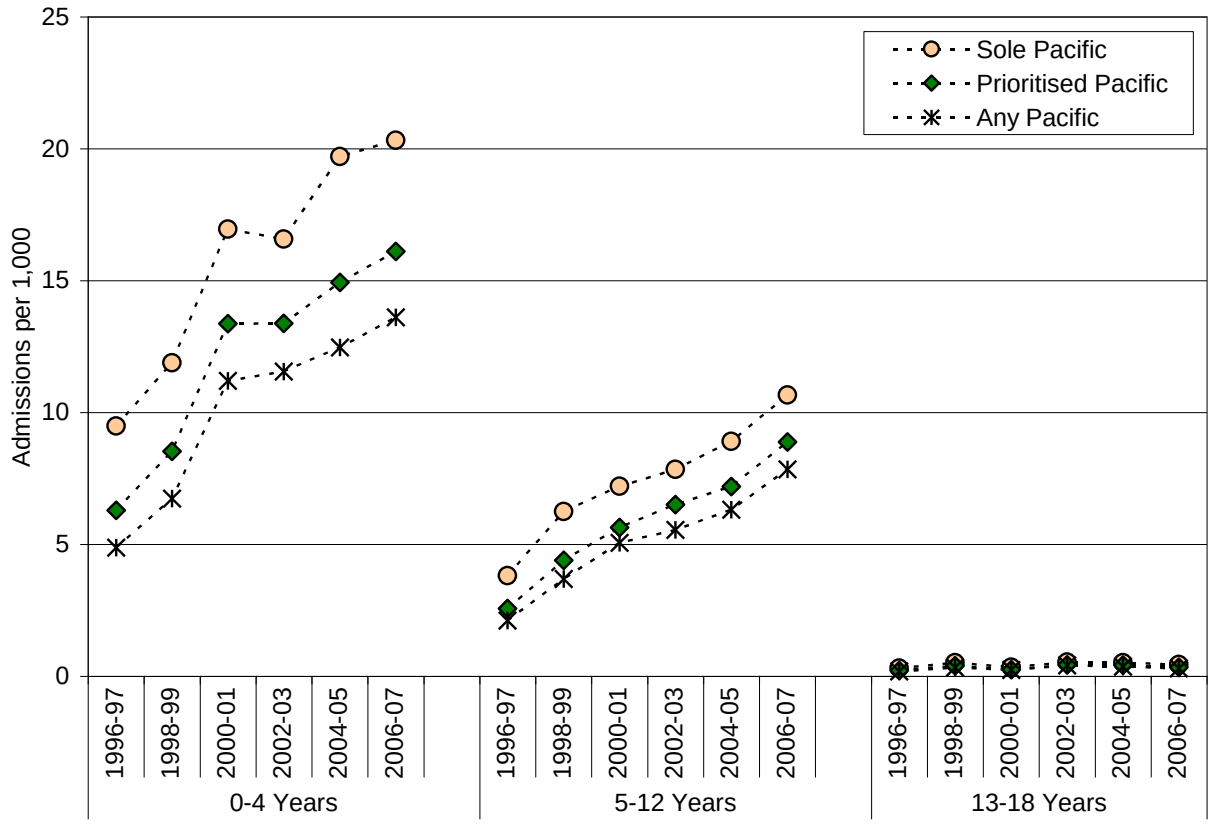
In New Zealand during 2003-2007, there were no marked seasonal variations in hospital admissions for dental caries, although numbers were lowest in January (**Figure 129**).

Figure 127. Hospital Admissions for Dental Caries in Children and Young People 0-18 Years by Ethnicity, New Zealand 1996-2007



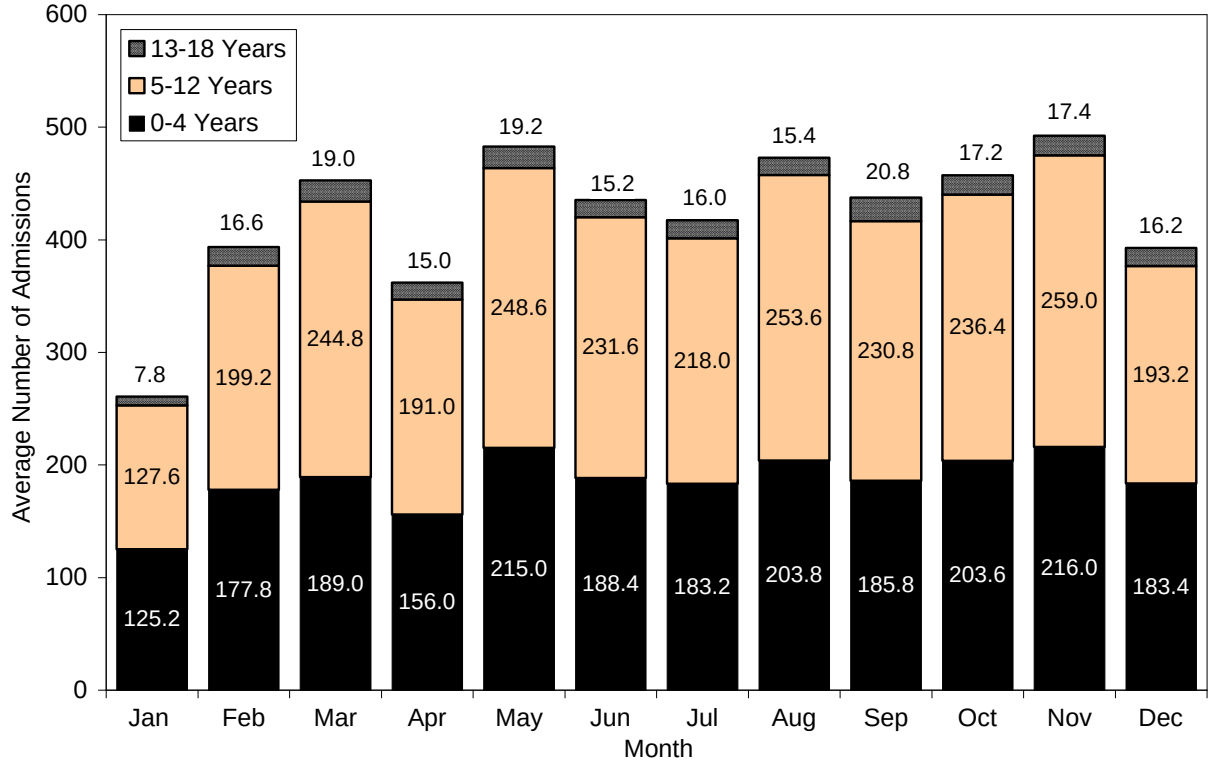
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised

Figure 128. Hospital Admissions for Dental Caries in Children and Young People 0-18 Years by Pacific Ethnicity Classification, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 129. Average Number of Hospital Admissions for Dental Caries per Month in Children and Young People 0-18 Years, New Zealand 2003-2007



Source: National Minimum Dataset

Admissions for Dental Caries Amongst Pacific Groups in New Zealand

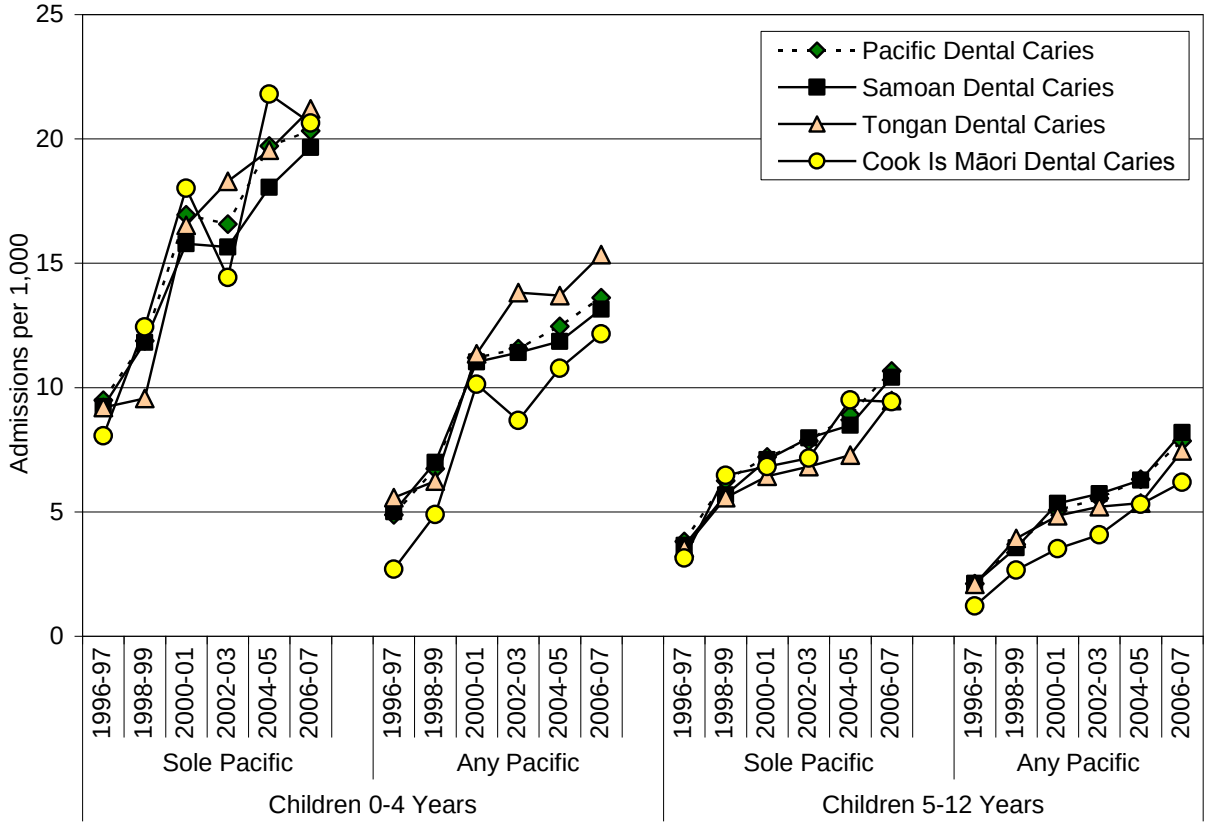
Pacific Group Trends

During 1996-2007, there were no consistent differences in admissions for dental caries between Samoan, Tongan and Cook Island Māori preschool and school age children in either the Sole or Any categories (**Figure 130**).

Distribution by Pacific Group

Amongst pre-school age children during 2003-2007 (using the Sole/ Any classification), dental caries admissions for Pacific children were *significantly higher* than for non-Māori non-Pacific children in each of the Sole and Any groups. While the pattern was similar for primary school age children in the Sole Pacific groups, within the Any groups, admissions were only *significantly higher* for Samoan, Tongan, Cook Island Māori, Fijian and Tokelauan children (**Table 97**).

Figure 130. Hospital Admissions for Dental Caries in Pacific Children 0-4 Years and 5-12 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Table 97. Distribution of Hospital Admissions for Dental Caries in Pacific Children 0-4 and 5-12 Years by Pacific Group, New Zealand 2003-2007

Any Pacific										
Pacific Group	0-4 Years					5-12 Years				
	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	1,074	214.8	12.34	2.24	2.10-2.39	903	180.6	7.03	1.52	1.42-1.63
Any Tongan	560	112.0	14.66	2.66	2.44-2.90	342	68.4	6.47	1.40	1.26-1.56
Any Cook Island Māori	434	86.8	10.59	1.92	1.74-2.12	329	65.8	5.33	1.15	1.03-1.29
Any Niuean	132	26.4	8.37	1.52	1.28-1.80	102	20.4	4.48	0.97	0.80-1.18
Any Fijian	80	16.0	15.43	2.80	2.25-3.48	75	15.0	9.59	2.08	1.66-2.60
Any Tokelauan	67	13.4	13.41	2.43	1.91-3.09	85	17.0	11.15	2.41	1.95-2.99
Any Other Pacific	55	11.0	10.16	1.84	1.41-2.40	39	7.8	5.11	1.11	0.81-1.51
Any Pacific	2,209	441.8	12.83	2.33	2.21-2.45	1,788	357.6	6.89	1.49	1.42-1.57
Any Māori	4,192	838.4	12.58	2.28	2.19-2.38	4,190	838.0	7.87	1.70	1.64-1.77
Non-Māori Non-Pacific	5,034	1,006.8	5.51	1.00		7,412	1,482.4	4.62	1.00	
Sole Pacific										
Pacific Group	0-4 Years					5-12 Years				
	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	743	148.6	18.57	3.37	3.12-3.63	644	128.8	9.38	2.03	1.87-2.20
Sole Tongan	407	81.4	20.23	3.67	3.32-4.05	273	54.6	8.43	1.82	1.62-2.06
Sole Cook Island Māori	245	49.0	19.71	3.57	3.15-4.06	206	41.2	8.83	1.91	1.66-2.19
Sole Niuean	53	10.6	21.76	3.95	3.02-5.16	50	10.0	9.85	2.13	1.62-2.81
Sole Fijian	35	7.0	30.30	5.50	3.96-7.62	45	9.0	16.52	3.58	2.67-4.78
Sole Tokelauan	25	5.0	24.73	4.48	3.04-6.61	56	11.2	26.33	5.70	4.40-7.39
Sole Other Pacific	39	7.8	18.62	3.38	2.47-4.61	31	6.2	9.27	2.01	1.41-2.85
Sole Pacific	1,559	311.8	19.67	3.57	3.37-3.77	1,323	264.6	9.61	2.08	1.96-2.20
Sole Māori	3,083	616.6	23.80	4.32	4.13-4.51	3,129	625.8	13.22	2.86	2.74-2.98
Non-Māori Non-Pacific	5,034	1,006.8	5.51	1.00		7,412	1,482.4	4.62	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); RR: Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted.

Summary

School Dental Service Data: During 1990-2006, a higher % of children were caries free at 5 years in fluoridated areas than in non-fluoridated areas, while mean DMFT scores at 12 years in fluoridated areas were lower. During 2004-2006, a lower % of Pacific and Māori children were caries free at 5 years, while Māori and Pacific children also had higher mean DMFT scores at 12 years, in both fluoridated and non-fluoridated areas. However, only children who have been assessed, completed treatment, and who are still 5 yrs or 12 years at the end of their treatment contribute data to this analysis. During this period, dental data coverage was higher for European > Māori > Pacific children. Thus trends and differences in oral health status for Pacific children must be interpreted with this in mind.

Dental Admissions: During 1990-2007, dental caries admissions increased markedly for preschool (0-4 years) and school age (5-12 years) children. While admissions for young people (13-18 years) more than trebled, increases were less marked than for younger age groups. During 2003-2007, dental caries were the leading cause of dental admissions in both Sole and Any Pacific children and young people. In preschool and school age children, diseases of the pulp / periapical tissue were the second most frequent cause, while embedded / impacted teeth made a significant contribution in young people.

During 1996-2007, dental caries admissions were higher for Pacific > Māori > Asian > European preschool age children, for Pacific and Māori > Asian and European primary school age children, and for European > Māori, Pacific and Asian young people. Admissions in all three age groups were higher for Sole than for Any Pacific children and young people. Amongst pre-school age children during 2003-2007 (using the Sole/ Any classification), dental caries admissions for Pacific children were significantly higher than for non-Māori non-Pacific children in each of the Sole and Any groups. While the pattern was similar for primary school age children in the Sole Pacific groups, within the Any groups, admissions were only significantly higher for Samoan, Tongan, Cook Island Māori, Fijian and Tokelauan children.

Local Policy Documents and Evidence Based Reviews Relevant to Oral Health in Children and Young People

In New Zealand, there are a number of policy documents which provide guidance to the health sector on the establishment of optimal oral health services, the identification of those most at risk of poor oral health and the roles the Ministry of Health and DHBs are expected to play in improving oral health outcomes for children and young people. In addition, there are a large number of reviews in the international literature which consider the effectiveness of particular interventions in the prevention and management of dental caries in this age group. These publications are briefly summarised in **Table 98**.

Table 98. Local Policy Documents and Evidence Based Reviews Relevant to Oral Health Issues in Children and Young People

Ministry of Health Policy Documents
Ministry of Health. **Good Oral Health for All, For Life: The Strategic Vision for Oral Health New Zealand**. 2006, Ministry of Health: Wellington http://www.MOH.govt.nz/ MOH.nsf/pagesmh/5117/$File/good-oral-health-strategic-vision-2006.pdf This document outlines the government's vision for oral health in New Zealand and identifies a number of priority groups including children and adolescents. It specifies a number of action points and outlines the roles the Ministry of Health and DHBs are expected to play in relation to each.
Ministry of Health. **Promoting Oral Health: A Toolkit To Assist The Development, Planning, Implementation And Evaluation Of Oral Health Promotion In New Zealand**. 2008, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/pagesmh/ 7384/$File/promoting-oralhealth-a-toolkit-jan08.pdf This toolkit was developed to help realise the aims Good Oral Health for All, For Life: The Strategic Vision for Oral Health New Zealand (above) by providing practical advice about how to design, deliver and evaluate programmes that promote oral health.
Ministry of Health. **A Toolkit for District Health Boards, Primary Health Care and Public Health Providers and for Oral Health Services Relating to Infants and Preschool Oral Health**. 2008, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/ indexmh/early-childhoold-oral-health-a-toolkit This toolkit outlines a strategy to improve early childhood oral health by the early identification of high risk children and targeting resources to children at highest need. It recommends a standardised programme of enrolment, with a risk assessment by oral health services before a child reaches 12 months old. The age of first contact is variable and depends on the results of this risk assessment and a targeted management protocol. This will require the development of a risk assessment tool and the training of Well Child / Tamariki Ora and other health professionals in its use.
Ministry of Health. **Community Oral Health Service: Facility Guideline**. 2006, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/pagesmh/5015/$File/community-oral-health-facility-guideline.pdf This document provides practical advice to DHBs on how to establish new oral health facilities, including information on planning, operational policies, support areas, location, functionality, infection control, health & safety, building services & environmental design, mobile units, equipment & information services.
Ministry of Health. **Child and Youth Health Toolkit.** 2004, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/pagesmh/5411/$File/childandyouthhealthtoolkit.pdf This toolkit is aimed at District Health Board (DHB) funders and planners, doctors, nurses, managers, primary health organisations, community providers, DHB boards, and other individuals and groups wanting to improve child and youth health. Chapter 12 (pg 65-72) focuses on oral health and outlines what needs to be done by funders and planners and health professionals in order to improve oral health outcomes.
Mauri Ora Associates. **Review of Māori Child Oral Health Services**. 2004, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/pagesmh/4755/$File/review-of-Māori -child-oral-health.pdf This report documents an evaluation of Māori oral health initiatives which was undertaken in 2004. A description of how services were being delivered at this time is outlined and 12 recommendations are made about how inequalities in Māori oral health can be improved.
Systematic and Other Reviews from the International Literature
Beirne P, Clarkson J, Worthington H. **Recall Intervals for Oral Health in Primary Care Patients**. Cochrane Database of Systematic Reviews 2007, Issue 4. The effects on oral health and the economic impact of altering the recall interval between dental check-ups (the time period between one dental check-up and the next) are unclear. Primary care dental practitioners in many countries have traditionally recommended dental check-ups at 6-monthly intervals for patients. Only one randomised controlled trial satisfied the eligibility criteria for this review. There is insufficient evidence to support or refute the practice of encouraging patients to attend for dental check-ups at 6-monthly intervals.

Hiiri A, Ahovuo-Saloranta A, Nordblad A, Mäkelä M. **Pit and Fissure Sealants Versus Fluoride Varnishes for Preventing Dental Decay in Children and Adolescents**. Cochrane Database of Systematic Reviews 2006, Issue 4.

Dental sealants are coatings applied by the dentist or by another person in dental care on the grooves of back teeth. These coatings are intended to prevent decay in the grooves of back teeth. Fluoride varnishes are sticky pastes that are professionally applied on teeth at a frequency of 2 to 4 times a year. The review found that dental sealants reduce tooth decay in grooves of permanent teeth more than fluoride varnishes. However, more high quality research is needed to clarify how big the difference is between the effectiveness of pit and fissure sealants and fluoride varnishes.

Ahovuo-Saloranta A, Hiiri A, Nordblad A, et al. **Pit and Fissure Sealants for Preventing Dental Decay in the Permanent Teeth of Children and Adolescents.** Cochrane Database of Systematic Reviews 2004, Issue 3.

Sealants are coatings applied by the dentist or by another person in dental care on the grooves of molar teeth. These coatings are intended to prevent the growth of bacteria that promote decay in the grooves of molar teeth. This review found that children who have their molar teeth covered by a resin based sealant are less likely to get dental decay in their molar teeth than children without sealant (after 4.5 years the sealed permanent molar teeth of children aged 5-10 years had reduction of decay in over 50% of biting surfaces compared to teeth without sealants).

Davenport C, Elley K, Salas C, et al. **The Clinical Effectiveness and Cost-Effectiveness of Routine Dental Checks: A Systematic Review and Economic Evaluation**. Health Technology Assessment, 2003. 7(7):1-127.

There was little evidence to support or refute the practice of encouraging 6-monthly dental checks in adults and children. Decision analysis modelling using UK data suggests that moving to longer (more than 6-monthly) dental check frequencies, rather than shortening the current interval, would be more cost-effective for dental decay but this varies depending on the risk group. It was not possible to model the cost-effectiveness of different frequencies of dental checks on periodontal disease and oral cancer.

Marinho V, Higgins J, Logan S, Sheiham A. **Topical Fluoride (Toothpastes, Mouth rinses, Gels Or Varnishes) For Preventing Dental Caries In Children And Adolescents.** Cochrane Database of Systematic Reviews 2003, Issue 4.

The use of fluoride toothpastes, mouth rinses, gels or varnishes reduces tooth decay in children and adolescents. This review of trials found that children aged 5-16 years who applied fluoride in the form of toothpastes, mouth rinses, gels or varnishes had fewer decayed, missing and filled teeth regardless of whether their drinking water was fluoridated. Supervised use of self applied fluoride increases the benefit. Fluoride varnishes may have a greater effect but more high quality research is needed to assess the magnitude of the effect, and whether they have adverse effects. There are a number of other Cochrane reviews which compare the efficacy of fluoride mouthwashes, gels, vanish and toothpastes [257-262]

Centre for Reviews and Dissemination. **Systematic Review of the Efficacy and Safety of the Fluoridation of Drinking Water**. CRD Report *18*. York: University of York. 2000.
http://www.york.ac.uk/inst/crd/projects/fluoridation.htm

This review found that although a large number of studies had been conducted in the past 50 years, there is a lack of reliable, good quality evidence in the fluoridation literature world-wide. The available evidence suggests that water fluoridation reduces caries prevalence but the degree to which it does so is not clear from the data (results of individual studies ranged from a substantial reduction to a slight increase in prevalence). This beneficial effect may also come at the expense of likely increases in the prevalence of dental fluorosis (mottled teeth). The research evidence is of insufficient quality to allow confident statements about other potential harms or whether there is any impact on social inequalities.

McDonagh M, Whiting P, Wilson P, et al. **Systematic Review of Water Fluoridation.** British Medical Journal, 2000. 321(7265):855-9.

This review on water fluoridation concluded that the evidence of a beneficial reduction in caries should be considered together with the increased prevalence of dental fluorosis. There was no clear evidence of other potential adverse effects.

Kay E, Locker D. A Systematic **Review of the Effectiveness of Health Promotion Aimed at Improving Oral Health.** Community Dental Health, 1998. 15(3):132-144.

This review concluded that oral health promotion which brings about the use of fluoride is effective for reducing caries. Chair side oral health promotion has been shown to be effective more consistently than other methods of health promotion. Mass media programmes have not been shown to be effective. It is also noted that the quality of research evaluating oral health promotion needs to be improved.

Guide to Community Preventative Services. **School Based or School-Linked Pit and Fissure Sealant Delivery Programmes are Effective at Reducing Tooth Decay in Children and Adolescents.** 2002. http://www.thecommunityguide.org/oral/oral-int-seal.pdf

Guide to Community Preventative Services. **Community Water Fluoridation is Recommended to Reduce Tooth Decay.** 2006. http://www.thecommunityguide.org/oral/oral-int-fluor.pdf

Guide to Community Preventative Services. **More Evidence is Needed to Determine the Effectiveness of Statewide or Community-Wide Sealant Promotion in Reducing Tooth Decay In Children and Adolescents**. 2006. http://www.thecommunityguide.org/oral/oral-int-ie-community-seal.pdf

Other Relevant Publications

National Health Committee. **Improving Child Oral Health and Reducing Child Oral Health Inequalities**. 2003, National Advisory Committee on Health and Disability; Wellington.

This report by the Public Health Advisory Committee (PHAC) reflects the PHAC's advice to the Minister of Health on how to improve child oral health and reduce inequalities. The PHAC identify 7 areas where they believe changes or improvements could be made including; influencing socioeconomic determinants; improving Māori oral health; encouraging fluoridation; reorienting oral health services; developing a responsive and skilled workforce; obtaining better information about child oral health and inequalities and using child oral health as an indicator of health inequalities. Each of these areas is discussed in detail and recommendations are made regarding appropriate action.

Å Constipation in Childhood

Introduction

Constipation is one of the most common gastrointestinal problems in children [263], and generally falls into one of two main categories: organic or functional [264]. Organic causes account for only 5% of constipation in this age group, and include anatomic, neuromuscular, metabolic and endocrine conditions. In contrast functional constipation accounts for 95% of childhood constipation, and has at various times been linked to diet, a lack of exercise and behavioural or psychological problems [264].

There is little information on the prevalence of constipation amongst New Zealand children, although overseas estimates vary from 0.7% to 29.6% depending on the population studied [263]. Such varying estimates arise, in part, because of the lack of a universally accepted definition for childhood constipation, although the Paris Consensus on Childhood Constipation Terminology Group recently suggested a definition for functional constipation which utilises the following criteria: a period of 8 weeks with at least two of the following symptoms; defecation frequency <3 / week, faecal incontinence frequency > 1 / week, passage of large stools that clog the toilet, a palpable abdominal or rectal faecal mass, stool withholding behaviour or painful defecation [265].

In terms of its management, a multi-dimensional approach to functional constipation is usually required, with most treatment algorithms beginning with the elimination of faecal impaction (if present), followed by the use of oral medications, education, attention to diet, behavioural modification and bowel retraining [264]. Overall, the aim is to ensure evacuation of the lower bowel on a near-daily basis, with treatment to regain the muscle tone of the anal canal potentially being required for 2-6 months and maintenance therapy for up to 2 years, necessitating ongoing support to both the child and parents over a considerable period [264].

In New Zealand, childhood constipation is considered an ambulatory sensitive condition, on the basis that education, anticipatory guidance and interventions offered in the primary care setting may prevent a significant proportion of hospital admissions in this age group [264]. The following section, which explores hospital admissions for constipation in Pacific children aged 0-14 years using information from the National Minimum Dataset, must thus be considered as reflecting the severe end of the spectrum, with the majority of children with constipation being managed effectively in the primary care or outpatient setting.

Data Sources and Methods

Definition
Hospital Admissions for Constipation in Children Aged 0-14 Years

Data Sources
Numerator: National Minimum Dataset: Hospital admissions for children 0-14 years with a primary ICD-10 diagnosis of Constipation (K590)
Denominator: NZ Census

Notes on Interpretation
Note 1: Appendix 4: The National Minimum Dataset outlines the limitations of the data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

Indicator Category
Proxy B

New Zealand Distribution and Trends

New Zealand Trends
In New Zealand, hospital admissions for constipation in children aged 0-14 years increased during the 1990s, reached a plateau in 2000-2005 and thereafter declined (**Figure 131**).

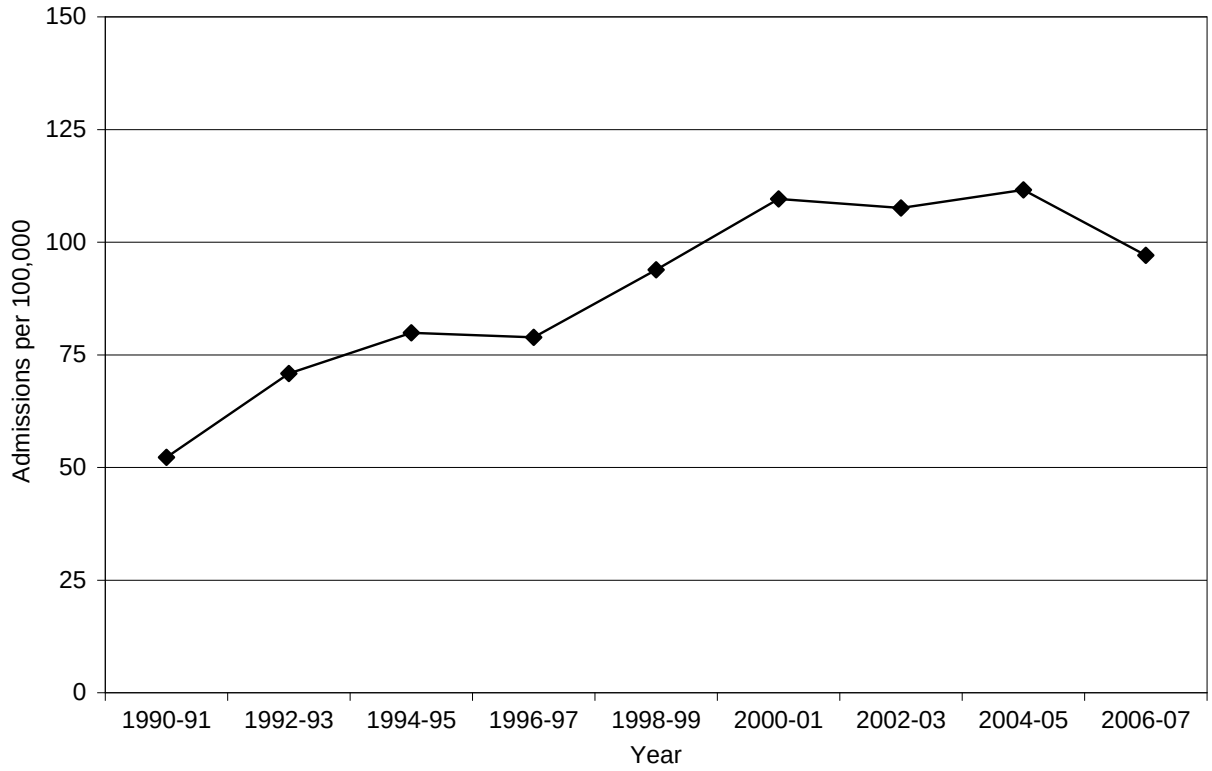
New Zealand Distribution by Age
In New Zealand during 2003-2007, constipation admissions were highest in children <4 years, with admissions declining progressively after 10 years of age (**Figure 132**).

NZ Distribution by Prioritised Ethnicity, NZDep, Gender and Rural / Urban Distribution
In New Zealand during 2003-2007, hospital admissions for constipation were *significantly higher* for European > Māori > Pacific and Asian children and those living in more deprived or urban areas (**Table 99**).

New Zealand Ethnic Specific Trends
In New Zealand during 1996-2007, while constipation admissions increased and then tapered off for all ethnic groups, rates remained persistently higher for European > Māori > Pacific > Asian children. In addition, admissions were higher for Sole Pacific than for Any Pacific children during this period (**Figure 133**).

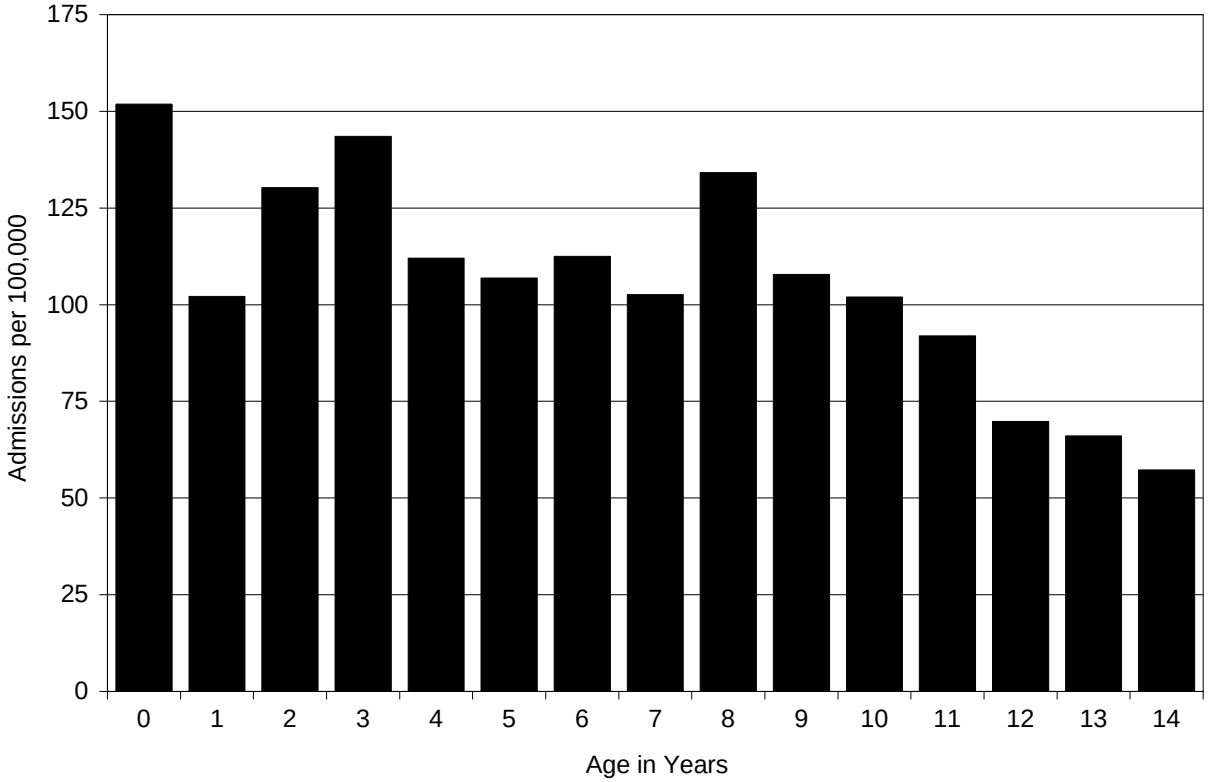
New Zealand Distribution by Season
During 2003-2007, there were no marked seasonal variations in hospital admissions for constipation in children (**Figure 134**).

Figure 131. Hospital Admissions for Constipation in Children Aged 0-14 Years, New Zealand 1990-2007



Source: Numerator-National Minimum Dataset; Denominator-Census.

Figure 132. Hospital Admissions for Constipation in Children 0-14 Years by Age, New Zealand 2003-2007



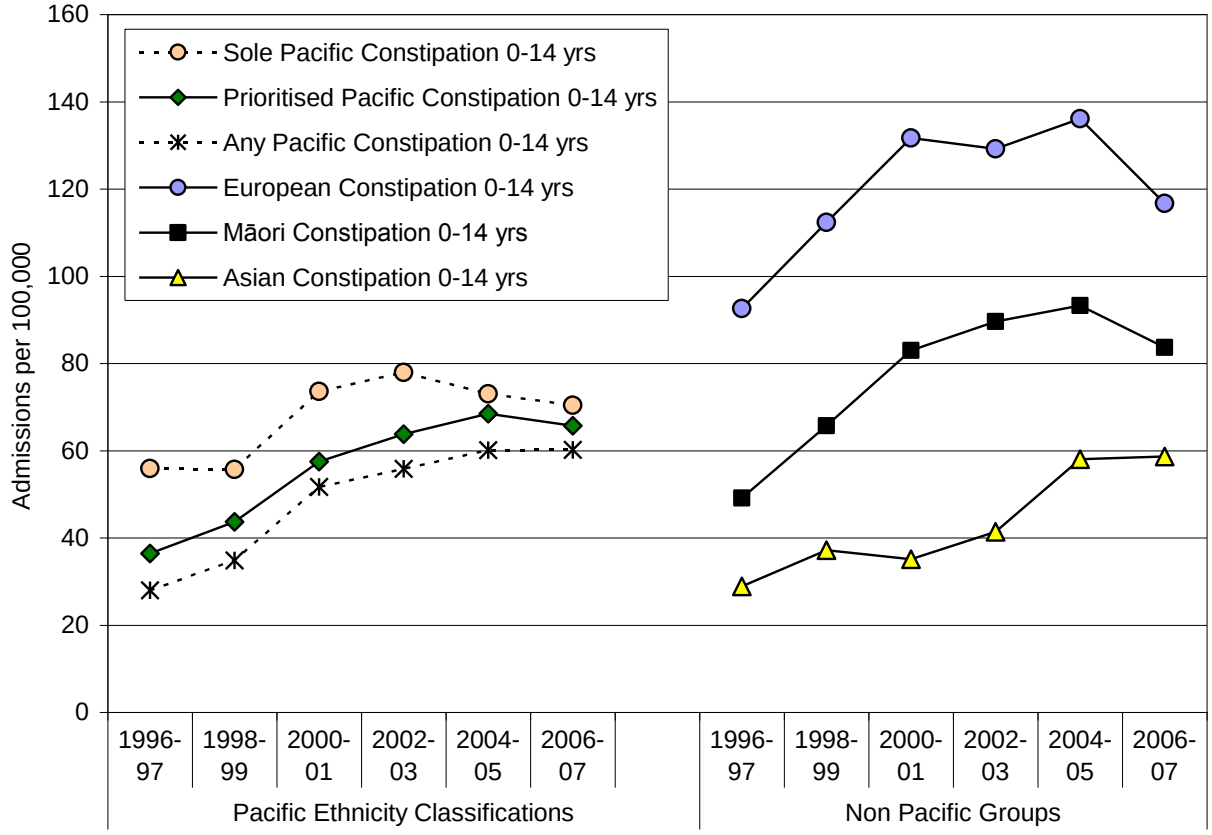
Source: Numerator-National Minimum Dataset; Denominator-Census.

Table 99. Risk Factors for Hospital Admissions due to Constipation in Children 0-14 Years, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	76.95	1.00		1-2	71.76	1.00	
2	66.33	0.86	0.74 - 1.01	3-4	83.16	1.16	1.04 - 1.29
3	64.24	0.83	0.71 - 0.98	5-6	115.08	1.60	1.45 - 1.78
4	102.44	1.33	1.15 - 1.54	7-8	136.57	1.90	1.73 - 2.10
5	106.79	1.39	1.20 - 1.60	9-10	117.42	1.64	1.49 - 1.80
6	123.39	1.60	1.40 - 1.84	Prioritised Ethnicity			
7	128.23	1.67	1.45 - 1.91	European	126.58	1.00	
8	144.52	1.88	1.64 - 2.14	Māori	91.25	0.72	0.67 - 0.78
9	134.38	1.75	1.53 - 1.99	Pacific	65.37	0.52	0.45 - 0.59
10	103.38	1.34	1.18 - 1.54	Asian	55.27	0.44	0.38 - 0.51
Gender				Urban / Rural			
Female	106.82	1.00		Urban	111.72	1.00	
Male	103.67	0.97	0.92 - 1.03	Rural	68.65	0.61	0.56-0.68

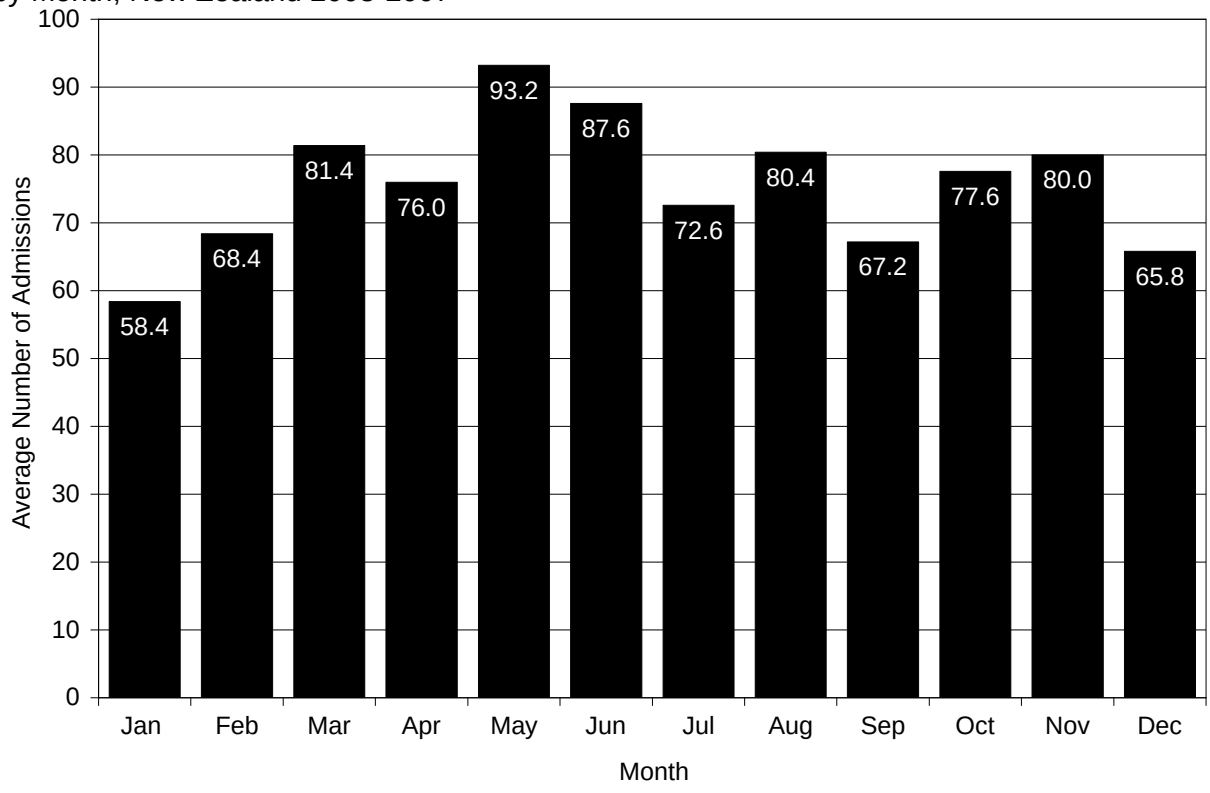
Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Rate per 100,000 per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Figure 133. Hospital Admissions for Constipation in Children 0-14 Years by Ethnicity, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Figure 134. Average Number of Hospital Admissions for Constipation in Children 0-14 Years by Month, New Zealand 2003-2007



Source: National Minimum Dataset

Constipation Admissions Amongst Pacific Groups in New Zealand

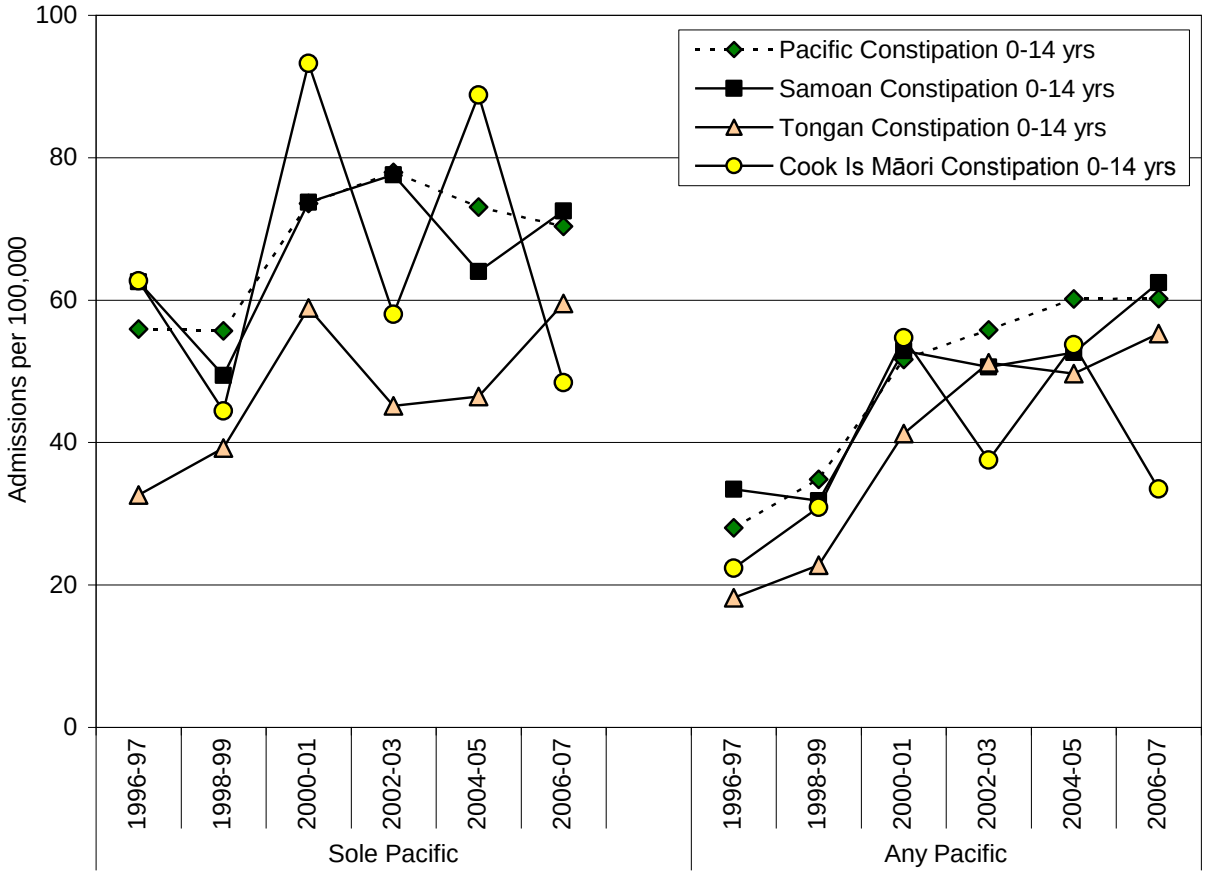
Pacific Group Trends

During 1996-2007, there were no consistent differences in constipation admissions between Samoan, Tongan and Cook Island Māori children, although rates for Sole Tongan children were generally lower than for Sole Samoan children during this period (**Figure 135**).

Distribution by Pacific Group

During 2003-2007 (using the Sole/ Any classification), constipation admissions for Sole and Any Samoan, Tongan and Cook Island Māori children were *significantly lower* than for non-Māori non-pacific children, as were admissions for Any Niuean children (**Table 100**).

Figure 135. Hospital Admissions for Constipation in Pacific Children and Young People 0-14 Years by Pacific Group, New Zealand 1996-2007



Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Table 100. Distribution of Hospital Admissions for Constipation in Pacific Children and Young People 0-14 Years by Pacific Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Any Samoan	137	27.4	55.96	0.49	0.41-0.58
Any Tongan	54	10.8	52.61	0.46	0.35-0.60
Any Cook Island Māori	50	10.0	42.67	0.37	0.28-0.49
Any Niuean	18	3.6	41.02	0.36	0.22-0.57
Any Fijian	22	4.4	146.55	1.27	0.84-1.94
Any Tokelauan	<5	s	s	s	s
Any Other Pacific	16	3.2	107.90	0.94	0.57-1.53
Any Pacific	286	57.2	58.19	0.51	0.45-0.57
Any Māori	909	181.8	91.25	0.79	0.74-0.85
Non-Māori Non-Pacific	3,391	678.2	114.94	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 100,000	RR	95% CI
Sole Samoan	87	17.4	69.25	0.60	0.49-0.75
Sole Tongan	32	6.4	53.20	0.46	0.33-0.66
Sole Cook Island Māori	28	5.6	66.65	0.58	0.40-0.84
Sole Niuean	8	1.6	90.40	0.79	0.39-1.57
Sole Fijian	<5	s	s	s	s
Sole Tokelauan	<5	s	s	s	s
Sole Other Pacific	15	3.0	240.39	2.09	1.26-3.47
Sole Pacific	179	35.8	71.23	0.62	0.53-0.72
Sole Māori	682	136.4	159.28	1.39	1.28-1.50
Non-Māori Non-Pacific	3,391	678.2	114.94	1.00	

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted.

Summary

In New Zealand, hospital admissions for constipation in children aged 0-14 years increased during the 1990s, reached a plateau in 2000-2005 and thereafter began to decline. During 2003-2007, admissions nationally were highest amongst children <4 years, with admissions declining progressively after 10 years of age. Admissions were also *significantly higher* for European > Māori > Pacific and Asian children and those living in more deprived or urban areas.

During 1996-2007, there were no consistent differences in constipation admissions between Samoan, Tongan and Cook Island Māori children, although rates for Sole Tongan children were generally lower than for Sole Samoan children. During 2003-2007 (using the Sole/ Any classification), constipation admissions for Sole and Any Samoan, Tongan and Cook Island Māori children were *significantly lower* than for non-Māori non-pacific children, as were admissions for Any Niuean children.

Local Policy Documents and Evidence Based Reviews Relevant to the Prevention and Management of Constipation

In 90-95 % of cases of constipation, no underlying organic cause (such as Hirschsprung's disease) is found [266, 267]. Functional childhood constipation is thus likely to be multifactorial, with genetic predisposition; low socioeconomic status; inadequate daily fibre intake; insufficient fluid intake and immobility; all proposed as factors that may contribute to the development of constipation [263]. In addition, while no systematic reviews were found which documented the role diet and exercise play in influencing constipation in children and young people, these remain common elements of current medical management.

In New Zealand there are no Ministry of Health documents which focus specifically on constipation. There are however, a number which consider healthy eating and physical activity more generally. In addition, while no systematic reviews were found which considered population level approaches to reducing constipation, a number of publications considered particular aspects of prevention or management. These are briefly summarised in **Table 101**.

Table 101. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention and Management of Constipation

Ministry of Health Policy Documents
There are no Ministry of Health documents which focus specifically on constipation. There are however, a number which consider healthy eating and physical activity, which may indirectly influence constipation rates (Note: Although no systematic reviews were identified which documented the role diet and exercise play in influencing constipation in children and young people, these remain common elements of current medical management). These include: Ministry of Health. **Healthy Eating Healthy Action: A Strategic Framework**.2003, Ministry of Health: Wellington.http://www.MOH.govt.nz/MOH.nsf/0/6088A42CFAA9AC6FCC256CE0000DAE66/$File/hehastrategicframework.pdf Healthy Eating - Healthy Action is a government initiative which aims to improve the nutrition and activity levels of New Zealanders as well as encouraging New Zealanders to maintain a healthy weight. The key messages centre on eating a healthy balanced diet, obtaining 30 minutes exercise a day, developing healthy environments which encourage healthy lifestyles and supporting breastfeeding infants for at least 6 months. **Mission-On**. http://www.sparc.org.nz/education/mission-on This programme is a multi agency campaign co-ordinated by SPARC which also has input from the Ministry of Health, Ministry of Youth Development and the Ministry of Education. This programme aims to establish healthy behaviours before a child enters school, and to embed healthy decision making after young people leave the school and family environments. There are ten initiatives which include improving nutrition and increasing physical activity.
Systematic and Other Reviews from the International Literature
Culbert T. Banez G. **Integrative Approaches to Childhood Constipation and Encopresis**. Pediatric Clinics of North America, 2007. 54(6):927-47. This review summarises the epidemiology of constipation and conventional modalities of treatment. It reviews the evidence for integrative approaches that may be used in conjunction with traditional therapies (e.g. bio-feedback, relaxation, mental imagery, hypnosis, stress management, diet, exercise and physical therapy, herbal, probiotics, functional medicine, massage, electrical nerve simulation, reflexology, acupuncture and homeopathy). The authors maintain that an integrated approach to the treatment of constipation and encopresis blends the best of conventional and alternative therapies into a plan that best suits the patient and their family.
Price, K. Elliott, T. **Stimulant Laxatives for Constipation and Soiling in Children**. Cochrane Database of Systematic Reviews 2001, Issue 3. This review considered the effectiveness of stimulant laxative treatment in children with chronic constipation who may also suffer from soiling / encopresis. No trials were found that met the selection criteria and the authors concluded there was insufficient evidence on the use and effectiveness of stimulant laxatives for treating childhood constipation.

van den Berg M, Benninga M, Di Lorenzo C. **Epidemiology of Childhood Constipation: A Systematic Review.** American Journal of Gastroenterology, 2006. 101(10):2401-9.

This systematic review assessed the prevalence, incidence, natural history, and co-morbid conditions of functional constipation in children. It found that childhood constipation was common world wide and that a range of definitions for constipation were used, emphasising the need for a generally accepted definition of paediatric constipation that can be used consistently. In this review, the peak age for onset could not be assessed with certainty, but approximately half of affected children developed constipation in the first year of life, with the highest prevalence being around preschool age. One third of children with chronic constipation remain constipated into adolescence despite intensive therapeutic management. While adult constipation was more common in individuals of low socioeconomic status, this pattern has not been confirmed in paediatric studies.

Brooks R, Copen R, Cox D, et al. **Review of the Treatment Literature for Encopresis, Functional Constipation, and Stool-Toileting Refusal.** Annals of Behavioural Medicine, 2000. 22(3):260-267.

This review identified 9 randomised controlled studies involving medical, behavioural, psychological, and biofeedback treatments for encopresis / functional constipation and stool-toileting refusal in school-age children (none were identified in preschool children). It found no evidence to support the routine use of psychotherapy or anal sphincter biofeedback in the treatment of paediatric faecal elimination dysfunctions, beyond the benefits derived from a comprehensive medical-behavioural intervention. There are few controlled treatment outcome studies in this area and the authors emphasise the need for further research.

Other Relevant Publications

Two studies looking at the role of nurse lead clinics are included below which may be of interest to DHBs, given the potential implications for service delivery.

Sullivan P. Burnett C. Juszczak E. **Parent Satisfaction in a Nurse Led Clinic Compared with a Paediatric Gastroenterology Clinic for the Management of Intractable, Functional Constipation.** Archives of Disease in Childhood, 2006. 91(6):499-501.

This study assessed parent satisfaction with a nurse led clinic for children with intractable, functional constipation vs. a paediatric gastroenterology outpatient clinic. A validated questionnaire covering six domains (provision of information, empathy with the patient, technical quality and competence, attitude towards the patient, access to and continuity with the caregiver, and overall satisfaction) was employed. Results indicated a high "total" satisfaction with clinical care, which significantly favoured in the nurse led clinic. Differences were consistent across all domains, with the authors concluding the results provided firm evidence that parents were satisfied with the care they receive in both the paediatric and nursing clinic setting. The study adds support to the development of nurse led services to manage intractable, functional constipation in children.

Burnett C, Juszczak E, Sullivan P. **Nurse Management of Intractable Functional Constipation: A Randomised Controlled Trial**. Archives of Disease in Childhood, 2004. 89(8):717-22.

This randomised control trial evaluated the effectiveness of a nurse led clinic (NLC) vs. a consultant led paediatric gastroenterology clinic (PGC) for the management of chronic constipation. Children (age 1–15 years) with functional constipation were randomised following medical assessment, to follow up in either a NLC or PGC. An escalating algorithm of treatment was used, with 52 children being randomly assigned to the NLC and 50 to the PGC. At their last visit (or later confirmed by telephone) 34 children in the NLC and 25 children in the PGC were confirmed cured, with the median time to cure being 18.0 months in the NLC and 23.2 months in the PGC, with the probability of being cured being 33% higher in the NLC. The authors concluded that a NLC can significantly improve follow up for children with intractable constipation, with the results highlighting an important role for clinic nurse specialists in the management of children with gastrointestinal disease.

Forthcoming Publications

National Institute for Health and Clinical Excellence*:* **Constipation: The Diagnosis and Management of Idiopathic Childhood Constipation in Primary and Secondary Care** is currently being developed and is expected to be issues in 2010. http://www.nice.org.uk/guidance/index.jsp?action=byID&o=11807

ISSUES MORE COMMON IN YOUNG PEOPLE

Most Frequent Causes of Hospital Admission and Mortality

Introduction

Before considering the more detailed analyses of sexual and reproductive health issues which follow, it is worthwhile briefly reviewing the most frequent causes of hospital admission and mortality for Pacific young people during the past five years. It is hoped that the brief summary tables presented below will provide the reader with an overall context, within which to consider the relative importance of the various health issues experienced by Pacific young people in recent years.

Data Source and Methods

Definition

1. Most Frequent Causes of Mortality in Young People Aged 15-24 Years
2. Most Frequent Causes of Hospital Admission in Young People Aged 15-24 Years

Data Sources

1. Most Frequent Causes of Mortality in Young People Aged 15-24 Years

Numerator: National Mortality Collection: Deaths in Young People (15-24 yrs) by main underlying cause of death

Denominator: NZ Census

2. Most Frequent Causes of Hospital Admissions in Young People Aged 15-24 Years

Numerator: National Minimum Dataset: Hospital admissions in young people (15-24 yrs). For acute and arranged admissions, the reason for admission was derived from the primary diagnosis (ICD-10) code, while for waiting list admissions this was derived from the primary procedure (ICD-10) code.

Denominator: NZ Census

Notes on Interpretation

Note 1: Because the procedures for booking (acute / arranged / waiting list) reproductive health admissions (e.g. for childbirth) varied by DHB, in this analysis reproductive health admissions (as defined by their primary diagnosis ICD-10 code) were treated as a separate category. Coverage of therapeutic abortions in the hospital admission dataset is partial, so the figures may not accurately reflect the total number of terminations undertaken.

Note 2: To maintain consistency with the injury and mental health sections, injury and mental health inpatient admissions with an Emergency Medicine Specialty Code (M05-M08) on discharge were excluded (see *Appendix 4: The National Minimum Dataset* for rationale). In addition, the ACC admission type code was retired in 2004, potentially resulting in a spurious reduction in the number of children admitted under ACC.

Indicator Category

Admissions: Proxy B-C; Mortality: Ideal B

Most Frequent Causes of Hospital Admission

In New Zealand during 2003-2007, pregnancy and childbirth were the leading causes of hospital admission for both Any and Sole Pacific young people. In terms of other hospital admissions, injury / poisoning followed by serious skin infections were the leading causes of acute admissions, while injury / poisoning followed by neoplasms / chemotherapy / radiotherapy were the leading reasons for arranged admission. Removal of internal fixation devices, followed by procedures on the skin and subcutaneous tissue were the leading causes of waiting list admissions for both Any and Sole Pacific young people (**Table 102, Table 103**).

Most Frequent Causes of Mortality

In New Zealand during 2001-2005, injury / poisoning was the most frequent cause of mortality for both Sole and Any Pacific young people, followed by intentional self harm. Neoplasms however also made a significant contribution (**Table 104**).

Table 102. Most Frequent Causes of Hospital Admissions in Any Pacific Young People 15-24 Years, New Zealand 2003-2007

Primary Diagnosis / Procedure	Total: 2003-2007	Rate per 1,000	% of Type	% of Total
Reproductive Admissions (by Primary Diagnosis)				
Pregnancy/Delivery/Postnatal	16,216	138.06	86.4	39.0
Therapeutic/Other Abortion	1,446	12.31	7.7	3.5
Miscarriage/Other Early Pregnancy Loss	1,007	8.57	5.4	2.4
Complication of Early Pregnancy Loss/Abortion	95	0.81	0.5	0.2
Total	18,764	159.76	100.0	45.1
Acute Admissions (by Primary Diagnosis)				
Injury/Poisoning	3,765	16.03	22.8	9.1
Serious Skin Infections	1,093	4.65	6.6	2.6
Abdominal/Pelvic Pain	1,008	4.29	6.1	2.4
Mental Health	780	3.32	4.7	1.9
Asthma	645	2.75	3.9	1.6
Urinary Tract Infection	534	2.27	3.2	1.3
Appendicitis	451	1.92	2.7	1.1
Viral Infection NOS	439	1.87	2.7	1.1
STI/Pelvic Inflammatory Disease	438	1.87	2.6	1.1
Acute URTI	391	1.66	2.4	0.9
Other Diagnoses	7,001	29.80	42.3	16.8
Total	16,545	70.43	100.0	39.8
Arranged Admissions (by Primary Diagnosis)				
Injury/Poisoning	631	2.69	17.8	1.5
Neoplasm/Chemotherapy/Radiotherapy	282	1.20	8.0	0.7
Dialysis	233	0.99	6.6	0.6
Mental Health	77	0.33	2.2	0.2
Immune Disorders	72	0.31	2.0	0.2
Other Diagnoses	2,248	9.57	63.4	5.4
Total	3,543	15.09	100.0	8.5
Waiting List Admissions (by Primary Procedure)				
Removal of Internal Fixateur	261	1.11	10.5	0.6
Skin/Subcutaneous Tissue Procedures	198	0.84	7.9	0.5
Dental Procedures	177	0.75	7.1	0.4
No Procedure Listed	164	0.70	6.6	0.4
Tonsillectomy +/- Adenoidectomy	114	0.49	4.6	0.3
Other Procedures	1,580	6.73	63.4	3.8
Total	2,494	10.62	100.0	6.0
ACC Admissions				
Total ACC Admissions	217	0.92	100.0	0.5
Total	41,563	256.81	100.0	100.0

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Injury and Mental Health Emergency Department Cases Removed (see Appendix 4). NMDS coverage of therapeutic abortions is partial, so figure may not accurately reflect the number of terminations during this period. ACC admission type code was retired in 2004, potentially resulting in a spurious reduction in the number of children admitted under ACC

Table 103. Most Frequent Causes of Hospital Admissions in Sole Pacific Young People 15-24 Years, New Zealand 2003-2007

Primary Diagnosis / Procedure	Total: 2003-2007	Rate per 1,000	% of Type	% of Total
Reproductive Admissions (by Primary Diagnosis)				
Pregnancy/Delivery/Postnatal	12,104	166.28	87.4	39.0
Therapeutic/Other Abortion	938	12.89	6.8	3.0
Miscarriage/Other Early Pregnancy Loss	743	10.21	5.4	2.4
Complication of Early Pregnancy Loss/Abortion	62	0.85	0.4	0.2
Total	13,847	190.22	100.0	44.6
Acute Admissions (by Primary Diagnosis)				
Injury/Poisoning	2,954	20.29	23.4	9.5
Serious Skin Infections	851	5.85	6.7	2.7
Abdominal/Pelvic Pain	744	5.11	5.9	2.4
Mental Health	478	3.28	3.8	1.5
Asthma	455	3.13	3.6	1.5
Urinary Tract Infection	422	2.90	3.3	1.4
Appendicitis	339	2.33	2.7	1.1
Viral Infection NOS	337	2.32	2.7	1.1
Bacterial/Viral Pneumonia	316	2.17	2.5	1.0
STI/Pelvic Inflammatory Disease	310	2.13	2.5	1.0
Other Diagnoses	5,404	37.12	42.9	17.4
Total	12,610	86.61	100.0	40.7
Arranged Admissions (by Primary Diagnosis)				
Injury/Poisoning	507	3.48	19.2	1.6
Neoplasm/Chemotherapy/Radiotherapy	264	1.81	10.0	0.9
Dialysis	161	1.11	6.1	0.5
Mental Health	40	0.28	1.5	0.1
Tuberculosis	35	0.24	1.3	0.1
Other Diagnoses	1,638	11.25	61.9	5.3
Total	2,645	18.17	100.0	8.5
Waiting List Admissions (by Primary Procedure)				
Removal of Internal Fixateur	200	1.37	11.4	0.6
Skin/Subcutaneous Tissue Procedures	132	0.91	7.5	0.4
No Procedure Listed	121	0.83	6.9	0.4
Dental Procedures	117	0.80	6.7	0.4
Myringoplasty	77	0.53	4.4	0.2
Other Procedures	1,111	7.63	63.2	3.6
Total	1,758	12.08	100.0	5.7
ACC Admissions				
Total ACC Admissions	156	1.07	100.0	0.5
Total	31,016	308.15	100.0	100.0

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Injury and Mental Health Emergency Department Cases Removed (see Appendix 4). NMDS coverage of therapeutic abortions is partial, so figure may not accurately reflect the number of terminations during this period. ACC admission type code was retired in 2004, potentially resulting in a spurious reduction in the number of children admitted under ACC

Table 104. Most Frequent Causes of Mortality in Pacific Young People 15-24 Years, New Zealand 2001-2005

Cause of Death	Number: Total 2001-2005	Number: Annual Average	Rate per 100,000	% of Deaths
Any Pacific				
Injury / Poisoning	68	13.6	30.82	38.0
Intentional Self Harm	44	8.8	19.94	24.6
Neoplasm	19	3.8	8.61	10.6
Congenital Anomalies	6	1.2	2.72	3.4
All Other Causes	42	8.4	19.04	23.5
Total	179	35.8	81.14	100.0
Sole Pacific				
Injury / Poisoning	47	9.4	33.98	37.0
Intentional Self Harm	30	6.0	21.69	23.6
Neoplasm	16	3.2	11.57	12.6
Congenital Anomalies	5	1.0	3.62	3.9
All Other Causes	29	5.8	20.97	22.8
Total	127	25.4	91.81	100.0

Source: Numerator-National Mortality Collection; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details)

Summary

Mortality: During 2001-2005, injury / poisoning was the most frequent cause of mortality for both Sole and Any Pacific young people, followed by intentional self harm. Neoplasms however also made a significant contribution.

Admissions: During 2003-2007, pregnancy and childbirth were the leading causes of hospital admission for both Any and Sole Pacific young people. In terms of other admissions, injury / poisoning and serious skin infections were the leading causes of acute admissions, injury / poisoning and neoplasms / chemotherapy / radiotherapy were the leading reasons for arranged admissions, and removal of internal fixation devices and procedures on the skin and subcutaneous tissue were the leading causes of waiting list admissions for both Any and Sole Pacific young people.

Sexual and Reproductive Health

Sexual and Reproductive Health: An Overview

Introduction

Sexual and reproductive health is a key Government priority [268], and as the previous section has indicated, is also the leading cause of hospital admissions in New Zealand young people aged 15-24 years. In contrast to many other hospital admissions, however, reproductive health admissions (e.g. for the birth of a child) are largely positive events which reflect key transition points in the lives of young people, as well as the health system's first point of contact with the next generation of New Zealand children.

Despite this, unwanted pregnancy rates amongst New Zealand young people remain high [269], and a significant number are diagnosed with sexually transmitted infections each year [270]. Such figures potentially suggest that further work may be required if the health sector is to achieve the Ministry of Health's goal of "*a society where individuals have the knowledge, skills and confidence to enjoy their sexuality, to choose when or if to have children and to keep themselves safe from harm [271]*".

In achieving this goal, it is likely that a range of services and programmes will be required, which on the one hand assist young people to determine the timing of their pregnancies, to prevent unwanted pregnancies and to protect themselves from sexually transmitted infections, but which on the other hand ensure that those opting for parenthood can access a range of antenatal, labour and post-natal care in a format which meets their and their baby's needs.

With this in mind, the three sections which follow each explore the sexual and reproductive health needs of young people from a slightly different perspective:

1. **Teenage Births**: While many teenage pregnancies are both intended and wanted, many occur to women who find it difficult to adequately care for their children without significant levels of support from their families and social service agencies [271]. This section thus focuses on the role early motherhood plays in determining a young woman's subsequent life trajectory (e.g. educational attainment, income earning potential), as well as its influence on the resources available to her children during their crucial first years. In addition to providing an overview of the available local data on teenage births, this section also provides links to a range of reviews which consider the best ways to support teenage mothers in their parenting roles and personal development.
2. **Terminations of Pregnancy**: The Dunedin Multidisciplinary Health and Development Study [272] noted that amongst their birth cohort of 477 women, 36% had been pregnant <25 years of age, and that in 60% of cases the pregnancy had been unwanted. In this context, it has been suggested that access to reliable contraception and sexual health education play a significant role in reducing the large number of unwanted pregnancies in this age group [273]. Thus, in addition to providing an overview of the available local data on terminations of pregnancy, this section also provides links to a range of reviews which consider the effectiveness of programmes attempting to prevent unintended pregnancies amongst adolescents.
3. **Sexually Transmitted Infections (STIs):** STIs are one of the leading causes of preventable illness amongst New Zealand young people. Untreated they can have long term consequences including an increased risk of infertility, sub-fertility, ectopic pregnancy and cancer [271]. In addition to providing an overview of the available local data on STIs in young people, this section also provides links to a range of reviews which consider the best ways to prevent the transmission of STIs in the adolescent population.

Before reviewing each of these issues in more detail however, it is perhaps worthwhile considering adolescent sexual and reproductive health as a whole, as well as some of the policy documents and evidence based reviews which consider approaches to sexual and

reproductive health in general. The following section thus begins with a brief review of the most frequent causes of hospital admission for reproductive health issues in young Pacific women in New Zealand during the past 5 years, before reviewing a range of policy and evidence based review documents which consider approaches to sexual and reproductive health issues as a whole.

Data Sources and Methods

Definition
Most Frequent Causes of Reproductive Health Admission in Young Women Aged 15-24 Years

Data Sources
Numerator: National Minimum Dataset: ICD10
Denominator: Census

Indicator Category

Notes on Interpretation
Tests of statistical significance have not been applied to the data in this section, and thus any associations described do not imply statistical significance or non-significance.

Sexual and Reproductive Hospital Admissions

In New Zealand during 2003-2007, pregnancy and childbirth accounted for the majority of reproductive health admissions, as well as 39.0% of all admissions for both Any and Sole Pacific young people (both males and females) during this period. Early pregnancy loss made the second largest contribution, although the figures given for Therapeutic Abortions are likely to be an underestimate, with the National Minimum Dataset coverage of terminations only being partial in this age group (**Table 105**).

Table 105. Most Frequent Causes of Reproductive Hospital Admissions in Young Pacific Women 15-24 Years by Primary Diagnosis, New Zealand 2003-2007

Primary Diagnosis / Procedure	Total: 2003-07	Rate per 1,000	% of Type	% of All Admissions
Any Pacific				
Pregnancy/Delivery/Postnatal	16,216	138.06	86.4	39.0
Therapeutic/Other Abortion	1,446	12.31	7.7	3.5
Miscarriage/Other Early Pregnancy Loss	1,007	8.57	5.4	2.4
Complication of Early Pregnancy Loss/Abortion	95	0.81	0.5	0.2
Total	18,764	159.76	100.0	45.1
Sole Pacific				
Pregnancy/Delivery/Postnatal	12,104	166.28	87.4	39.0
Therapeutic/Other Abortion	938	12.89	6.8	3.0
Miscarriage/Other Early Pregnancy Loss	743	10.21	5.4	2.4
Complication of Early Pregnancy Loss/Abortion	62	0.85	0.4	0.2
Total	13,847	190.22	100.0	44.6

Source: Numerator-National Minimum Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rates are gender specific, but % of admissions in age group includes admissions for both males and females. Coverage of Therapeutic Abortions in the National Minimum Dataset is only partial so the figures given may be an underestimate.

Local Policy Documents and Evidence Based Reviews Relevant to the Sexual and Reproductive Health in General

While no Ministry of Health policy documents focus solely on sexual and reproductive health issues in young people aged 15-24 years, a number consider sexual and reproductive health more generally, or these issues within the wider youth health context. These publications are briefly reviewed in **Table 106**. (Note: Publications focusing on teenage births, terminations of pregnancy and STIs are reviewed separately in their respective sections).

Table 106. Local Policy Documents and Evidence Based Reviews Relevant to Sexual and Reproductive Health Issues Generally

Ministry of Health Policy Documents
Ministry of Health. **Sexual and Reproductive Health: A Resource Book for New Zealand Health Care Organisations**. 2003, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/pagesmh/2678?Open This document is the second stage in the Ministry's Sexual and Reproductive Health Strategy and aims to assist DHBs improve their population's uptake of effective contraception and safe sex practices. It highlights the importance of a youth focused approach and involving young people in the design of services. School and community-based health care centres are identified as being useful in increasing young people's access of health services. Increasing the effectiveness of primary care in delivering contraceptive advice, and the delivery of effective sexual and reproductive health services are also identified as potentially useful strategies. The document outlines 10 characteristics of effective sex and HIV education programmes and also emphasises the importance of a multi prong approach to sexual and reproductive health which includes addressing income inequalities, developing long term education campaigns with media support, increasing societal respect for young people, taking a research-based approach, ensuring access to free or low cost contraception, the acknowledgement of cultural diversity and the need for different approaches for Māori and Pacific peoples. It also suggests goals for DHB's with specific evidence based strategies provided to assist DHBs to move towards these.
Ministry of Health. **Youth Health: A Guide to Action**. 2002, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/wpg_Index/Publications-Youth+Health:+A+Guide+to+Action This Guide considers the health sector's response to youth health issues in general and proposes a shift in the way the sector has traditionally seen young people from being a problem to be solved, to being active participants in creating a healthier world. It proposes ways of making health services more youth-focused and youth-knowledgeable and emphasises the need to gather better information on factors that affect young people's health, as well as 'what works' for young people. It includes a series of recommended action points (under *Goal 3: A Measurable Improvement in Young People's Physical Health*) relating to *Reducing STIs and Unintended Pregnancies*.
Ministry of Health. **Sexual and Reproductive Health Strategy - Phase 1**. 2001, Ministry of Health: Wellington. http://www.MOH.govt.nz/MOH.nsf/ea6005dc347e7bd44c2566a40079ae6f/e4f15d3a93cf5a48cc256ae90016ef56?OpenDocument This document outlines the Ministry of Health's overall direction in sexual and reproductive health, and considers strategic directions in the areas of societal attitudes, values and behaviour; personal knowledge, skills and behaviour; services; and information. It forms the strategic platform upon which the second phase document *Sexual and Reproductive Health: A Resource Book for New Zealand Health Care Organisations* (see above) was based.
Systematic and Other Reviews from the International Literature
Bearinger L. Sieving R. Ferguson J. Sharma V. **Global Perspectives on the Sexual and Reproductive Health of Adolescents: Patterns, Prevention, and Potential**. Lancet, 2007. 369(9568):1220-31. This review presents three key strategies for prevention and health promotion for adolescents that together are essential for improving their sexual and reproductive health. These include: clinical services that assure accessible and high-quality reproductive health care; sex education programmes that provide developmentally appropriate, evidence-based curricula; and youth development strategies to enhance life skills, connections to supportive adults, and educational and economic opportunities. All adolescents need access to quality youth-friendly services provided by clinicians trained to work with this population. Sex education programmes should offer accurate, comprehensive information while building skills for negotiating sexual behaviours. Girls and boys also need equal access to youth development programmes that connect them with supportive adults and with educational and economic opportunities.

Lyons M, Barrett S, Ashton J. **Review of Contraception, Induced Abortion and Fertility Services**.2002. The Health Care Needs Assessment Series. http://hcna.radcliffe-oxford.com/famplanframe.htm This review contains information on the effectiveness of interventions, models of care and outcome measures, audits and targets that may be applicable in the New Zealand setting.
Blum R. **Healthy Youth Development as a Model For Youth Health Promotion. A Review**. Journal of Adolescent Health, 1998. 22(5):368-75. This review explores the concepts of risk and resiliency and considers how intervention programmes can be developed based on the concept of resiliency. Resiliency based programmes are described as being built upon communitywide, intersectoral collaborations that are not bounded by traditional agency roles or administrative constraints; are focused on enhancing competence in young people at least as much as reducing a given risk behaviour or undesirable outcome; see youth as part of the solution, not just the focus of the problem; start early in the life of young people; are intensive, continuous and developmentally appropriate; have staff who are collaborative, interdisciplinary, and not overly professionalised; are willing to do what it takes to be successful; and values young people. The differences between resiliency based approaches and risk reduction programmes is highlighted. A number of examples of resiliency based programmes are given in the text.
Forthcoming Publications
National Institute for Health and Clinical Excellence. **Personal, social and health education focusing on sex and relationships and alcohol education**. A public health guidance document currently being developed. Completion date 2009. http://www.nice.org.uk/guidance/index.jsp?action=byID&o=11673
Guide to Community Preventive Services: Systematic Reviews and Evidence Based Recommendations**: Interventions to reduce sexual risk behaviours or increase protective behaviours to prevent HIV, STD, and pregnancy in adolescents**. Under development. http://www.thecommunityguide.org/sex/

Teenage Births

Introduction

New Zealand's teenage pregnancy rates are high by international standards [274]. High teenage pregnancy rates are a cause for concern, as young maternal age has been associated with a number of adverse birth outcomes [275]. In New Zealand, teenage pregnancy increases the risk of both preterm birth and small for gestational age [2]. There is currently debate, however, as to whether it is the social or biological factors that play the greatest role, with risk of preterm birth amongst teens disappearing in a number of different studies, once the effects of socioeconomic disadvantage had been taken into account [275].

In addition to its biological effects, teenage pregnancy may also impact on educational attainment, not only of the young women themselves, but also the aspirations and opportunities available to their children [52]. In this context, the Christchurch Health and Development Study, which followed a cohort of 515 women to the age of 25 years, noted that early motherhood (having a baby <21 years and not adopting it out) was associated with poorer mental health outcomes (depression, anxiety, suicidal ideation and suicide attempts), educational outcomes (the attainment of any qualifications, tertiary qualifications, or a university degree) and economic circumstances (welfare dependency, paid employment and family income). Risk of young motherhood, however, was in turn significantly influenced by previous family circumstances (e.g. having parents without formal qualifications, low family living standards during childhood) and once these factors were taken into account, the associations between early motherhood and poorer mental health outcomes disappeared. Significant associations however remained for poorer educational outcomes and economic circumstances at age 25 [276].

Similarly, when the same group was compared to those who became pregnant <21 years, but then underwent an abortion, they had significantly poorer outcomes in 6/10 measures of income, education, welfare dependency and domestic violence. Again, once prior family circumstances were taken into account, the majority of these differences disappeared, with the exception of educational achievement, which remained significantly poorer amongst young mothers [277]. Such findings potentially suggest that significant further effort is required in order to ensure that young mothers are able to realise their full educational potential and to be able to create a secure economic base for themselves and their children.

The following section explores teenage births amongst Pacific women living in New Zealand using information from the birth registration dataset. Policy and evidence based review documents which consider how teenage mothers might be supported at the population level, are considered at the end of this section.

Data Source and Methods

Definition
Teenage Births: Births to Women < 20 Years of Age

Data Source
Numerator: Birth Registration Dataset: All births to women <20 years of age
Denominator: NZ Census: All women aged 15-19 years

Notes on Interpretation
Note 1: In the analysis of total teenage pregnancy rates, information on terminations was obtained from the Abortion Supervisory Committee and miscarriage rates were estimated at 10% of induced abortions and 20% of live births [278].

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

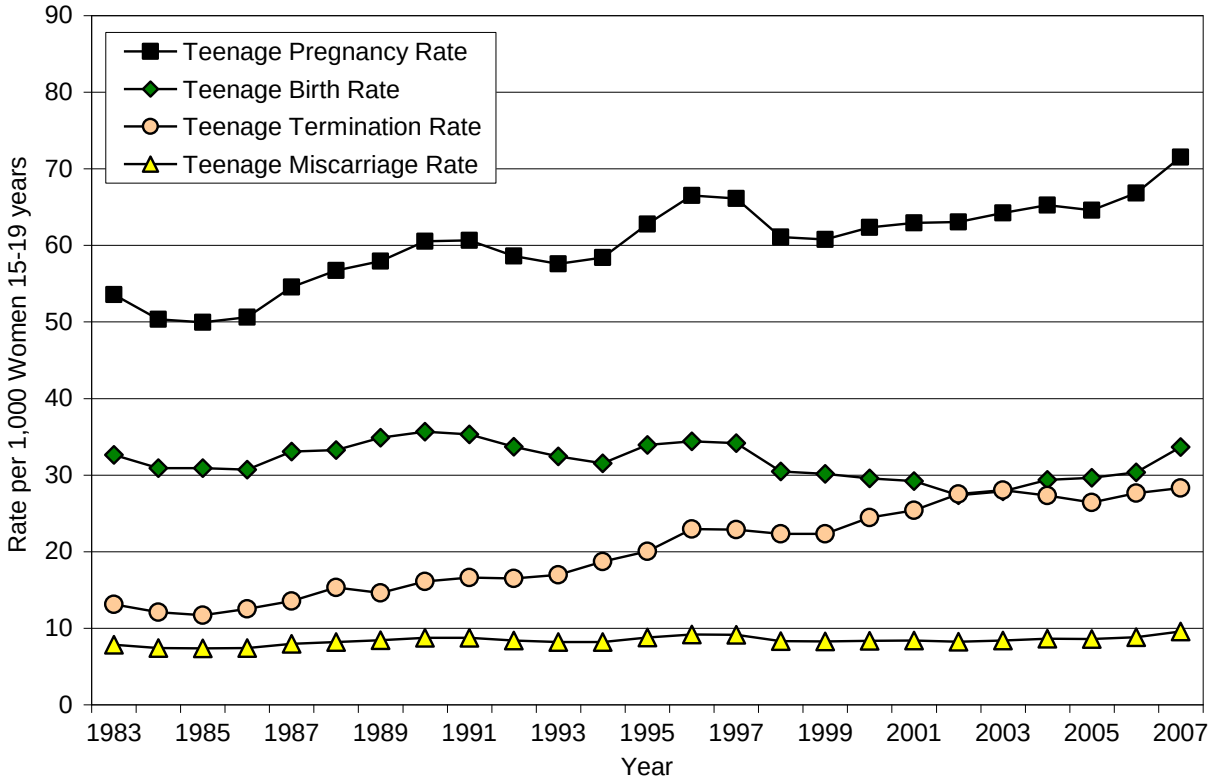
Indicator Category
Ideal B

New Zealand Distribution and Trends

New Zealand Trends

While New Zealand's teenage birth rates remained relatively static during 1983-2007, teenage pregnancies increased as the result of a steady increase in the number of teenagers seeking a therapeutic abortion. By 2003, for every woman giving birth in her teenage years, there was one corresponding termination of pregnancy (**Figure 136)**.

Figure 136. New Zealand's Teenage Pregnancy Rates, 1983-2007



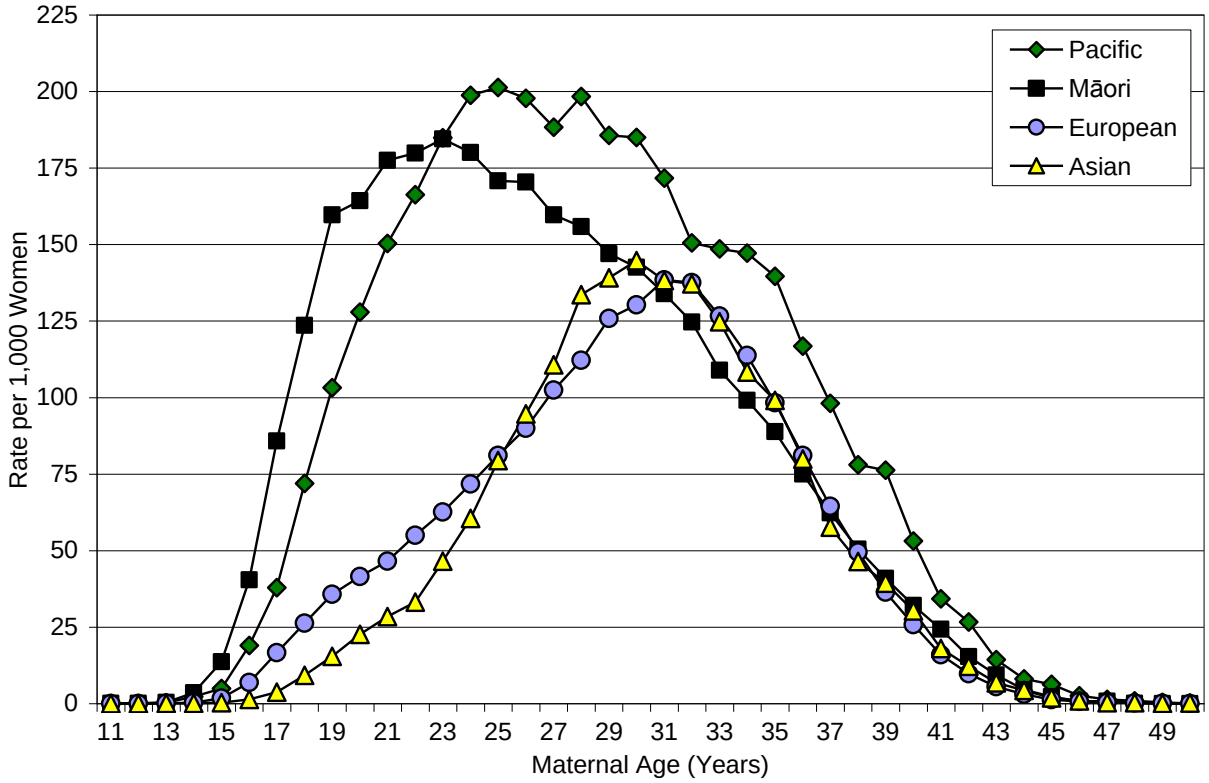
Source: Numerator-Birth Registration Dataset; Denominator-Census. Note: Miscarriage rates were estimated at 10% of induced abortions and 20% of live births [278]

Table 107 Teenage Birth Rates by Prioritised Ethnicity, NZ Deprivation Index Decile and Rural / Urban Location, New Zealand 2003-2007

Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
1	7.17	1.00		1-2	8.72	1.00	
2	10.35	1.44	1.29 - 1.62	3-4	16.37	1.88	1.75 - 2.01
3	13.42	1.87	1.68 - 2.09	5-6	25.09	2.88	2.69 - 3.07
4	19.42	2.71	2.44 - 3.00	7-8	39.00	4.47	4.20 - 4.76
5	20.39	2.85	2.57 - 3.15	9-10	53.16	6.09	5.74 - 6.47
6	29.64	4.14	3.75 - 4.56	Prioritised Ethnicity			
7	35.54	4.96	4.51 - 5.45	European	16.98	1.00	
8	42.29	5.90	5.37 - 6.48	Māori	81.29	4.79	4.65 - 4.93
9	44.63	6.23	5.68 - 6.83	Pacific	45.56	2.68	2.57 - 2.81
10	61.43	8.57	7.83 - 9.38	Asian	6.29	0.37	0.34 - 0.41
Urban / Rural							
Urban	30.51	1.00					
Rural	27.35	0.90	0.86 - 0.94				

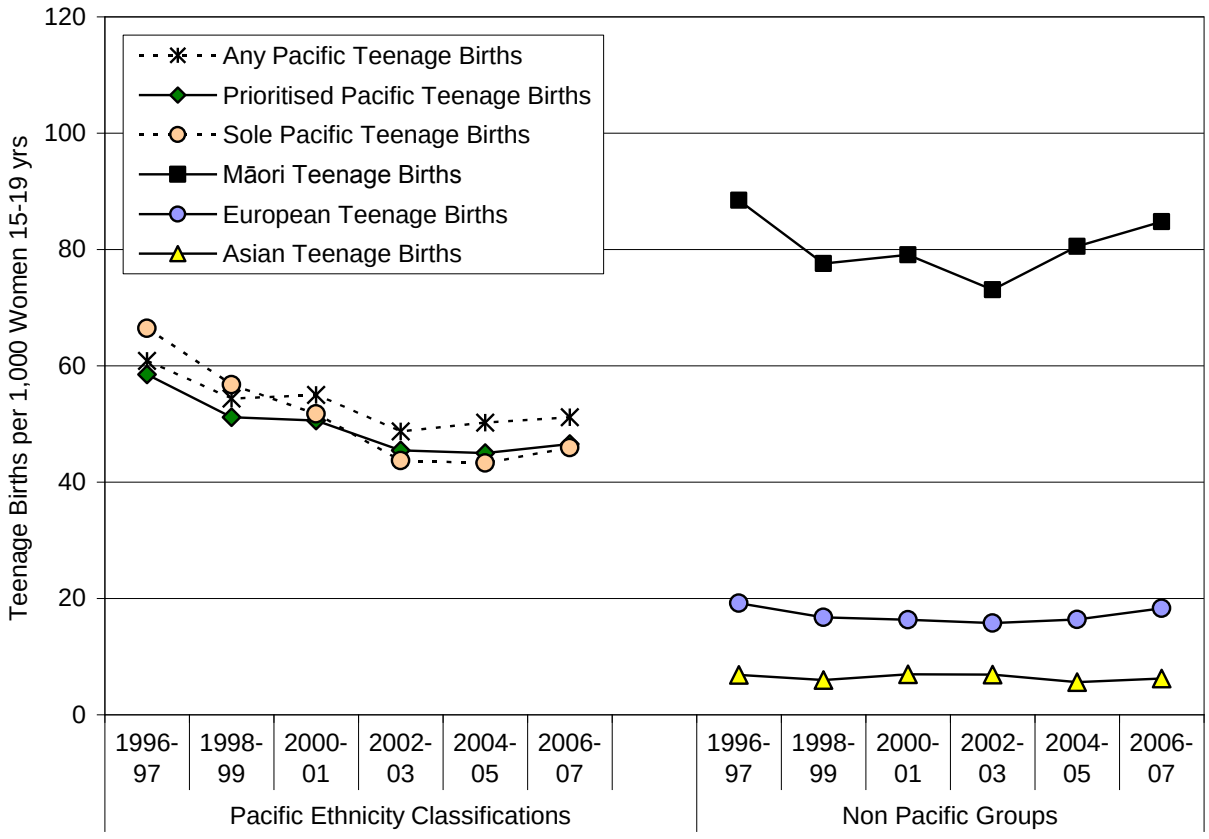
Source: Numerator-Birth Registration Dataset; Denominator-Census; Rate per 1,000 women aged 15-19 yrs per year; Ethnicity is Level 1 Prioritised; RR: Rate Ratios are unadjusted.

Figure 137. Birth Rates by Maternal Age and Ethnicity, New Zealand 2003-2007



Source: Numerator-Birth Registration Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised

Figure 138. Teenage Birth Rates by Maternal Ethnic Group, New Zealand 1996-2007



Source: Numerator-Birth Registration Dataset; Denominator-Census. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

Distribution by Prioritised Ethnicity, NZDep and Rural / Urban Location

In New Zealand during 2003-2007, teenage birth rates were *significantly higher* for Māori > Pacific > European > Asian women and those living in urban or deprived areas (**Table 107**). Higher teenage birth rates amongst Māori and Pacific women, however, must be seen in the context of a shift to the left in the maternal age distribution (i.e. towards birth at a younger age), as well as the higher overall fertility rates (at all ages) for Māori and Pacific women (**Figure 137**). Similarly, during 1996-2007, teenage births rates were consistently higher for Māori > Pacific > European > Asian women. Amongst Pacific women, teenage birth rates were higher for Any Pacific than Sole Pacific women during 2002-2007, although these differences were reversed during the late 1990s (**Figure 138**).

Teenage Births Amongst Pacific Groups in New Zealand

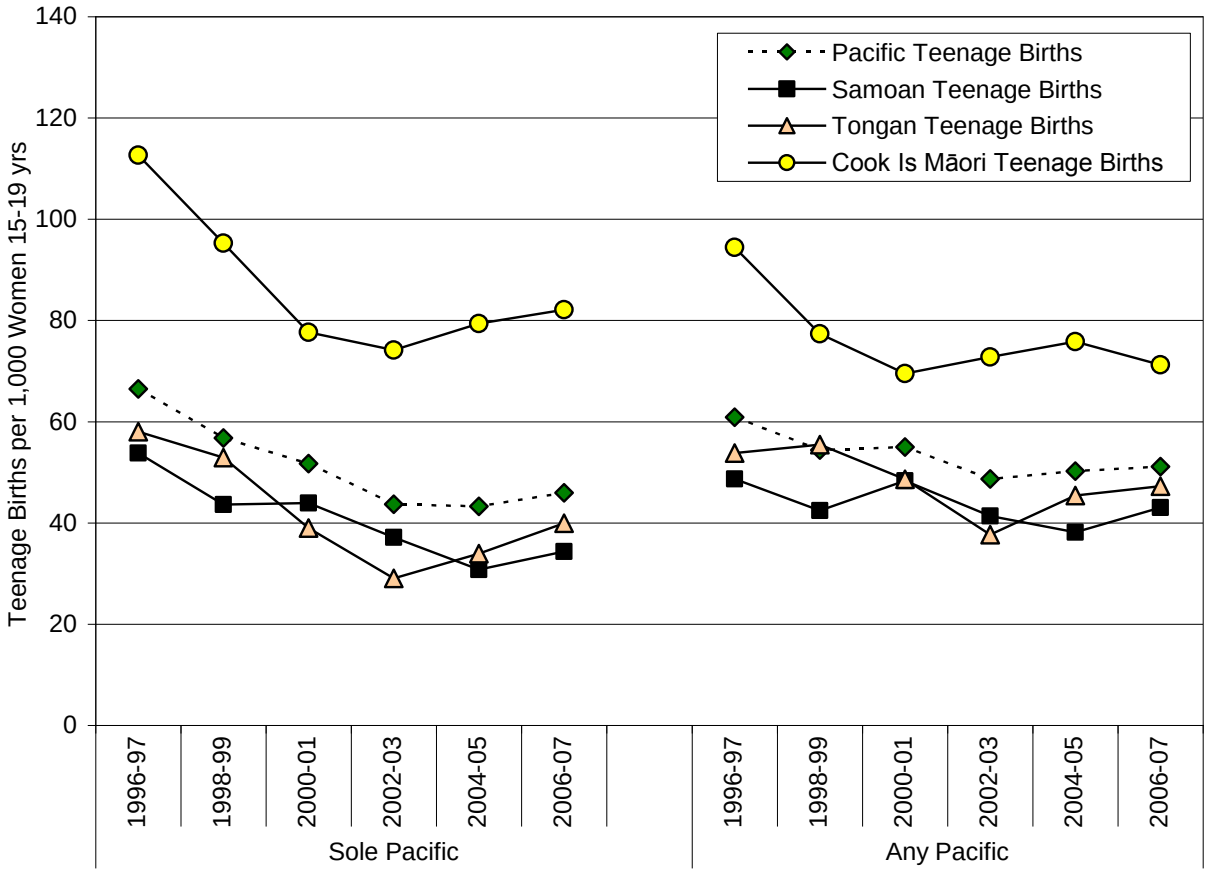
Pacific Group Trends

During 1996-2007, teenage birth rates were consistently higher for Cook Island Māori women than for Samoan and Tongan women in both the Sole and Any Categories (**Figure 139**).

Distribution by Pacific Group

During 2003-2007 (using the Sole / Any Classification), teenage birth rates for all of New Zealand's largest Pacific groups (with the exception of Sole Fijian women) were *significantly higher* than for non-Māori non-Pacific women. Within the Any category, teenage birth rates for Cook Island Māori and Niue women were *significantly higher* than for the other Pacific groups studied. Similarly, within the Sole category, rates for Cook Island Māori and Niue women were *significantly higher* than for Samoan, Tongan and Fijian women (**Table 108**).

Figure 139. Teenage Birth Rates by Pacific Group, New Zealand 1996-2007



Source: Numerator-Birth Registration Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Table 108. Distribution of Teenage Births (Excluding Terminations and Miscarriages) in Pacific Women by Pacific Ethnic Group, New Zealand 2003-2007

Any Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Any Samoan	1,327	265.4	40.69	2.76	2.61-2.93
Any Tongan	514	102.8	45.14	3.07	2.81-3.35
Any Cook Island Māori	1,140	228.0	73.32	4.98	4.69-5.29
Any Niuean	399	79.8	67.31	4.57	4.15-5.04
Any Fijian	67	13.4	28.89	1.96	1.55-2.49
Any Tokelauan	74	14.8	40.31	2.74	2.19-3.43
Any Other Pacific	88	17.6	44.11	3.00	2.44-3.68
Any Pacific	3,311	662.2	50.32	3.42	3.28-3.56
Any Māori	11,614	2,322.8	81.29	5.52	5.37-5.68
Non-Māori Non-Pacific	7,715	1,543.0	14.72	1.00	
Sole Pacific					
Pacific Group	Number: Total 2003-2007	Number: Annual Average	Rate per 1,000	RR	95% CI
Sole Samoan	664	132.8	33.53	2.28	2.11-2.46
Sole Tongan	269	53.8	35.55	2.42	2.14-2.72
Sole Cook Island Māori	591	118.2	79.12	5.38	4.96-5.83
Sole Niuean	113	22.6	64.50	4.38	3.66-5.24
Sole Fijian	13	2.6	14.25	0.97	0.56-1.66
Sole Tokelauan	30	6.0	45.46	3.09	2.18-4.38
Sole Other Pacific	46	9.2	51.45	3.50	2.64-4.64
Sole Pacific	1,726	345.2	44.18	3.00	2.85-3.16
Sole Māori	6,965	1,393.0	104.62	7.11	6.89-7.33
Non-Māori Non-Pacific	7,715	1,543.0	14.72	1.00	

Source: Numerator-Birth Registration Dataset; Denominator-Census. Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details); Rate Ratios are compared to the non-Māori non-Pacific group and are unadjusted.

Summary

While New Zealand's teenage birth rates remained relatively static during 1983-2007, teenage pregnancy rates increased, as the result of a steady increase in the number of teenagers seeking a therapeutic abortion. By 2003, for every woman giving birth in her teenage years, there was one corresponding termination of pregnancy. During 2003-2007, teenage birth rates were *significantly higher* for Māori > Pacific > European > Asian women and those living in urban or deprived areas. Higher teenage birth rates amongst Māori and Pacific women however must be seen in the context of a shift to the left in the maternal age distribution (i.e. towards birth at a younger age), as well as the higher overall fertility rates (at all ages) for Māori and Pacific women.

During 2003-2007 (using the Sole / Any Classification), teenage birth rates for all of New Zealand's largest Pacific groups (with the exception of Sole Fijian women) were *significantly higher* than for non-Māori non-Pacific women. Within the Any category, teenage birth rates for Cook Island Māori and Niue women were *significantly higher* than for the other Pacific groups studied. Within the Sole category, rates for Cook Island Māori and Niue women were *significantly higher* than for Samoan, Tongan and Fijian women.

Policy Documents and Evidence Based Reviews Relevant to the Support of Teenage Parents

Strategies to address teenage pregnancy can be divided into: those which aim to provide support to teenage parents; and those which attempt to reduce the burden of unintended pregnancies in adolescents. As there are currently no Ministry of Health policy documents which consider the support of teenage parents, **Table 109** considers the small number of evidence based reviews which have explored the most effective ways to support teenage parents in their parenting roles.

Note: Reviews which consider the **Prevention of Unintended Pregnancies in Adolescents** are considered in more detail in the Section on **Terminations of Pregnancy**, commencing on **page 314.** In addition, policy documents which consider sexual and reproductive health issues more generally are reviewed in **Table 106** on **page 305**.

Table 109. Policy Documents and Evidence Based Reviews Relevant to the Support of Teenage Parents

Ministry of Health Policy Documents
There are no Ministry of Health policy documents which focus solely on the support of teenage parents. A range of policy documents however consider sexual and reproductive health issues more generally (see links on previous page).
Systematic and Other Reviews from the International Literature
Macdonald G, Bennett C, Dennis J, et al. **Home-Based Support for Disadvantaged Teenage Mothers**. Cochrane Database of Systematic Reviews 2008, Issue 1. This review was undertaken to assess the effectiveness of home-visiting programmes for women who have recently given birth and who are socially or economically disadvantaged. The authors included 5 studies in and concluded that overall the evidence provided only limited support for the effectiveness of home visiting as a means of improving the range of maternal and child outcomes considered. This review was subsequently withdrawn because of a number of questions regarding its methodology and the validity of the conclusions drawn. Specifically, concerns were raised regarding the heterogeneous nature of the trials included and the way these were combined which may have concealed important differences. The review is currently being reviewed will be re-published following investigation, revision and peer review.
Dennison C. **Teenage Pregnancy: An Overview of the Research Evidence**. 2004, Health Development Agency. http://www.nice.org.uk/nicemedia/documents/teenpreg_evidence overview.pdf This briefing reviews key research on teenage pregnancy and parenthood. The topics covered include research on young people's sexual behaviour, sources of sex and relationships information, what works in preventing teenage pregnancy, who is at risk of becoming a teenage parent, and how to support teenage parents. It draws on a range of sources including systematic reviews of the effectiveness of prevention and support interventions, national surveys and primary research studies. The emphasis is on the UK and specifically English research.
Swann C, Bowe K, McCormick G, Kosmin M. **Teenage Pregnancy and Parenthood: A Review of Reviews (Evidence Briefing**). 2003. Health Development Agency. http://www.nice.org.uk/nicemedia/documents/teenpreg_evidence_briefing.pdf This document pulls together learnings from review-level data about effective interventions to reduce teenage pregnancy rates, as well as information about interventions which improve the outcomes for teenage parents. It is intended to inform policy and decision makers, NHS providers, public health physicians and other public health practitioners. The review was written for a British audience but contains information relevant to the New Zealand context.

Coren E, Barlow J. **Individual and Group-Based Parenting Programmes for Improving Psychosocial Outcomes for Teenage Parents and their Children**. Cochrane Database of Systematic Reviews 2001, Issue 3.

A range of studies suggest that children of teenage parents experience adverse outcomes. Parenting programmes are increasingly being used to promote the well-being of parents and children, and this review aimed to determine whether such programmes can improve outcomes for teenage parents and their children. The review was based on a small number of studies, and therefore the findings are limited. The results suggest that parenting programmes may be effective in improving a range of psychosocial and developmental outcomes for teenage mothers and their children, although the authors noted that further research was needed in this area.

Akinbami L, Cheng T, Kornfeld D. **A Review of Teen-Tot Programmes: Comprehensive Clinical Care for Young Parents and their Children**. Adolescence, 2001. 36(142):381-393.

This paper reviewed the experiences of teen-tot programmes in improving outcomes and preventing repeat pregnancies. Studies were included if they described a programme including clinical health supervision, family planning and support for teenage parents (e.g. assistance with staying in school or obtaining community services). Each of the included studies had multidimensional interventions (e.g. well-child health visits; 24-hour on call system to an interdisciplinary team; individual counselling about financial management, school and work; and social worker review of family planning methods with referrals to a birth control clinic). While there was limited evidence upon which to judge the effectiveness of teen-tot programmes, the authors concluded teen-tot programmes had moderate success in preventing repeat pregnancies, helping teenage mothers continue their education, and improving parent and infant health over 6 to 18 months. It was acknowledged that study weaknesses may have impacted on the observed effectiveness.

NHS Centre for Reviews and Dissemination. **Preventing and Reducing the Adverse Effects of Unintended Teenage Pregnancies**. Effective Health Care, 1997. 3 (1).

This review summarises the research on approaches to preventing teenage pregnancy and alleviating its direct negative health and social effects. The review considered a number of issues, including programmes that support teenage mothers and found that the health and development of teenage mothers and their children benefited from programmes promoting access to antenatal care, targeted support by health visitors, social workers or 'lay mothers', and the provision of social support, educational opportunities and pre-school education.

Giuffrida A, Torgerson D. **Should We Pay The Patient: Review Of Financial Incentives To Enhance Patient Compliance.** British Medical Journal, 1997. 315:703-707.

This review considered whether financial incentives increase patients' compliance with healthcare treatments. The review included studies that used financial incentives to enhance patient compliance, defined as money, cash, or vouchers redeemable for other goods (food, cloths, gifts, etc). The reviewers excluded studies that reimbursed payments such as travel expenses. The majority of studies targeted low income patients, or other disadvantaged groups, including immigrants and the homeless. The review included 11 US studies from a number of different clinical settings, including two studies that targeted teenage mothers. Ten studies, including the two involving teenage mothers, showed that financial incentives promoted compliance. The authors make the point that financial incentives can be cost effective and also suggest that if low income is associated with non compliance then financial incentives may improve equity as people on lower incomes will be more sensitive to financial incentives.

Other Relevant Publications

Strunk J. **The Effect of School-Based Health Clinics on Teenage Pregnancy and Parenting Outcomes: An Integrated Literature Review**. Journal of School Nursing, 2008. 24(1):13-20.

This meta-synthesis reviewed the literature on the effects of school-based clinics on teenage pregnancy and parenting outcomes. The authors concluded that having school-based health clinics, nurse practitioners and school nurses can provide much needed services to pregnant and parenting teens. These services should include educational support, counselling, and community resources.

Johnson R, Denny SJ. **The Health and Wellbeing of Secondary School Students attending Teen Parent Units in New Zealand**. Auckland. The University of Auckland (2007). www.Youth 2000.ac.nz.

This document describes the results of a survey undertaken of 220 teenage parents attending Teen parent Units in New Zealand. The survey focused on issues related to the health and wellbeing of these students. The survey found that most teenage parents attending these facilities were well connected to their families and felt supported within the Teen Parent Units. However, the survey also identified a number of areas of concern including issues around sexual health, nutrition and mental health. The authors of this report hope that the document will provide information for funders, planners, providers and schools that will help improve the health and wellbeing of this group of young people and their children.

Terminations of Pregnancy

Introduction

By international standards, New Zealand's termination of pregnancy rates are at the higher end of the spectrum, along with those of the United States, Australia and Sweden [271]. In considering the factors contributing to New Zealand's high termination rates, the Dunedin Multidisciplinary Health and Development Study [272] noted that amongst their birth cohort of 477 women aged 26 years in 1998/99, 36% had been pregnant before 25 years of age, and that in 60% of cases the pregnancy had been unwanted (48% of unwanted pregnancies in this cohort ended in termination vs. 2% of wanted pregnancies). Factors associated with undesired pregnancy (where the pregnancy was both unwanted and the woman was unhappy about it at the time) included relationship duration (the shorter the relationship the more likely the pregnancy was to be undesired) and the number of previous pregnancies (with subsequent pregnancies being more desired than first or only pregnancies). The authors also noted that unwanted pregnancies were more likely to be the result of contraception not being used (55%) than it failing (40%), with the most common reasons cited for non-use of contraception being "not thinking about it" (40%), followed by the use of alcohol (25%). In addition, in 11% of cases women reported that their partners did not want to use a condom, with a further 6% reporting that they could not afford contraception [272].

Similarly the Pacific Islands Families (PIF) Study (a longitudinal study following a cohort of Pacific infants born in Auckland during 2000), noted that of 1365 mothers within this cohort, 60% had not planned their pregnancy, and that of these 70.8% were not using contraception when they conceived. Reasons for not using contraception included not thinking about it (46.8%), not liking to use contraception (42.5%), deciding to take a chance (39.4%), not wanting to risk associated weight gain (30.4%) and not thinking that they could have a baby (17.3%). Non-users of contraception were significantly more likely to lack post-school qualifications and to report a strong alignment with Pacific way of life and customs, with the authors concluding that further investigations were required into the accessibility and acceptability of family planning services, in order to ensure that such services were delivered in a way which maximised choices regarding the use of contraceptives [279].

The following section reviews the available information on terminations of pregnancy amongst women in New Zealand using information from the Abortion Supervisory Committee (via Statistics New Zealand). Policy and evidence based review documents which consider how the issue of unintended pregnancies might be addressed at the population level, are considered at the end of this section.

Data Sources and Methods

Definition

Legally Induced Terminations of Pregnancy Registered in New Zealand by the Abortion Supervisory Committee

Data Sources

Numerator: Abortion Supervisory Committee: Legally Induced Termination of Pregnancy (all age groups)
Denominator: NZ Census (women aged 15-44 years, unless otherwise specified)

Notes on Interpretation

Note 1: In New Zealand, information on the domicile of women presenting for a termination of pregnancy has only been recorded by the Abortion Supervisory Committee since 2004, with an agreement existing between the Committee and Statistics NZ that the only geographical breakdown of termination data will be at regional council level. Thus at present, information on terminations of pregnancy by DHB or NZDep Index decile is unavailable.

Note 2: Changes in the way ethnicity was coded during 2006 mean that trend data for European women may be unreliable, with those identifying as "New Zealanders" prior to 2006 being included in the European group, but from 2006 onwards these women were included in the "Other" ethnic group (in 2007 ~50 women identified as New Zealander's in abortion data while 10,550 identified as European [280]. In the denominator however, New Zealanders have been included in the European group throughout.

Note3: Tests of statistical significance have not been applied to the data in this section, and thus any associations described do not imply statistical significance or non-significance.

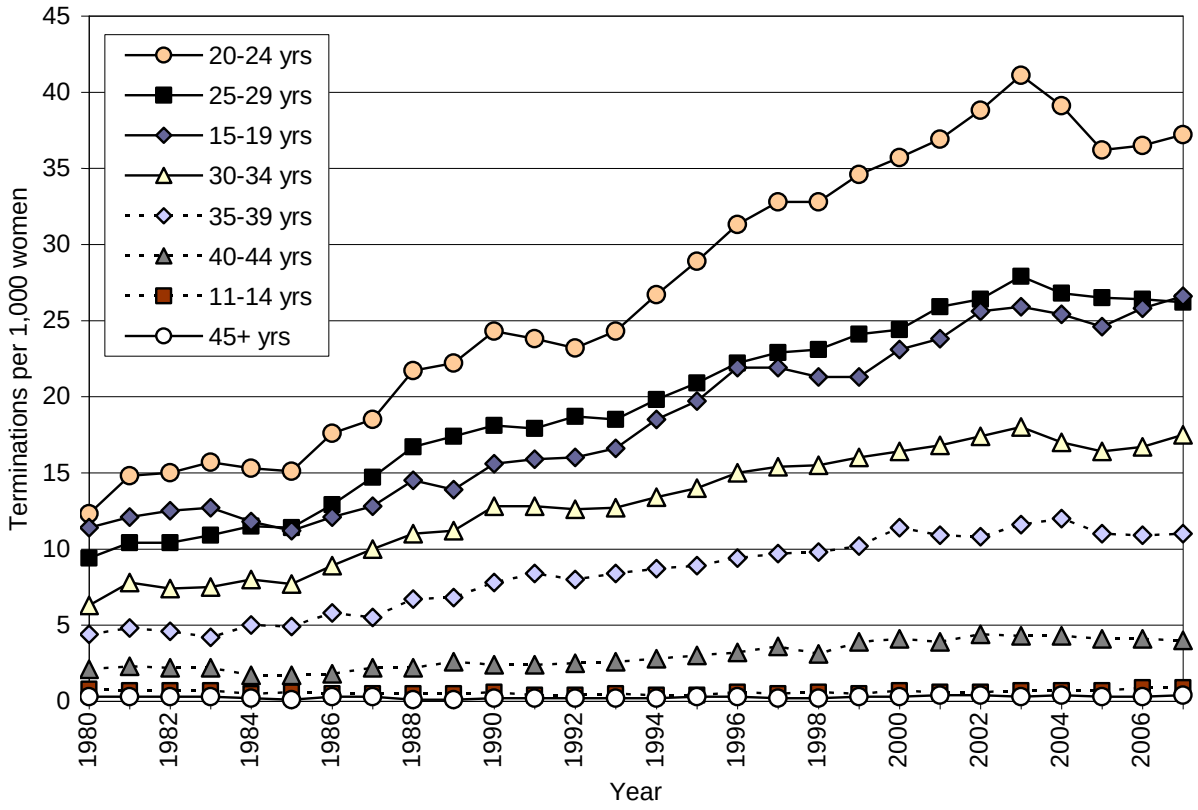
Indicator Category Ideal B

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1980-2007, terminations of pregnancy increased for all age groups, with the exception of those at the extremes of the age distribution (11-14 yrs and 45+ yrs) (**Figure 140**).

Figure 140. Trends in Termination of Pregnancy by Age, New Zealand 1980-2007



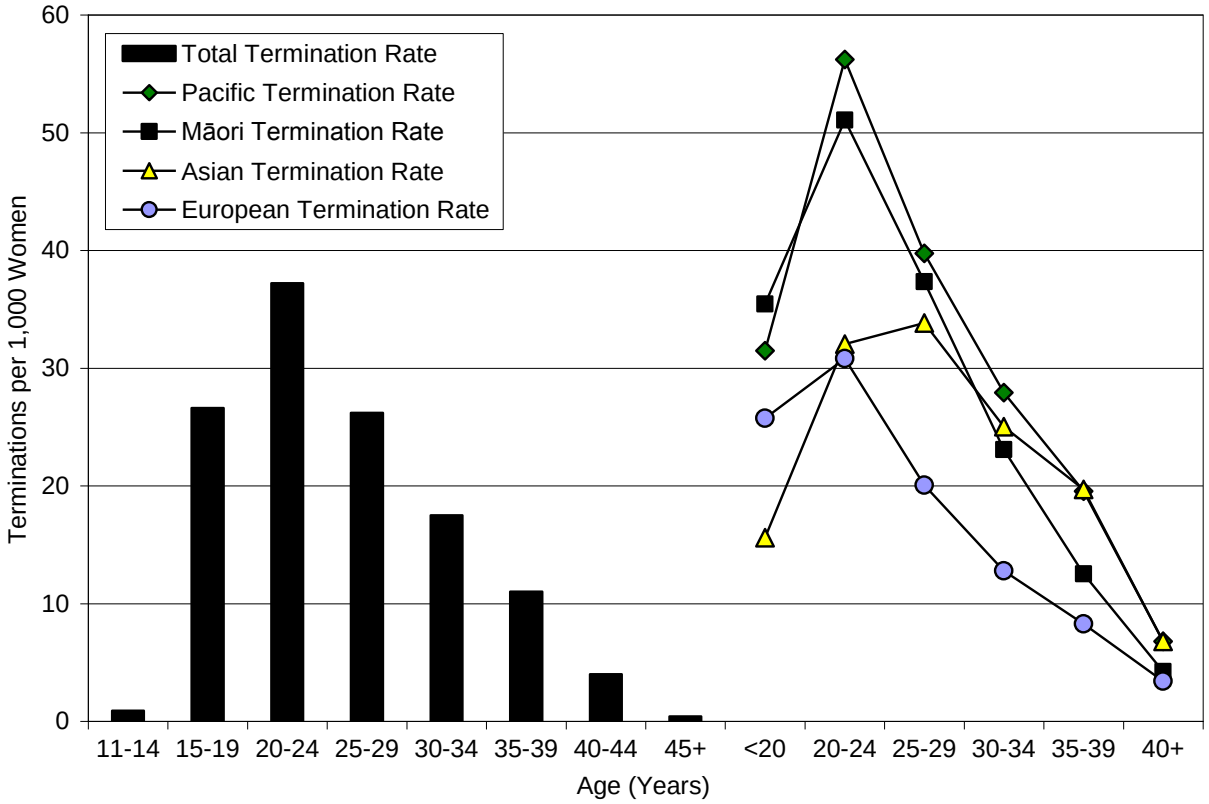
Source: Abortion Supervisory Committee via Statistics New Zealand [281]

Distribution by Age and Ethnicity

In New Zealand during 2007, termination rates were highest for women 20-24 years, followed by those 15-19 and 25-29 years. Terminations were lowest at the extremes of the age distribution (i.e. amongst those 11-14 and 45+ years). When broken down by ethnicity, similar peaks at 20-24 years of age were evident for Pacific, Māori and European women, while terminations for Asian women peaked in those 25-29 years of age (**Figure 141).**

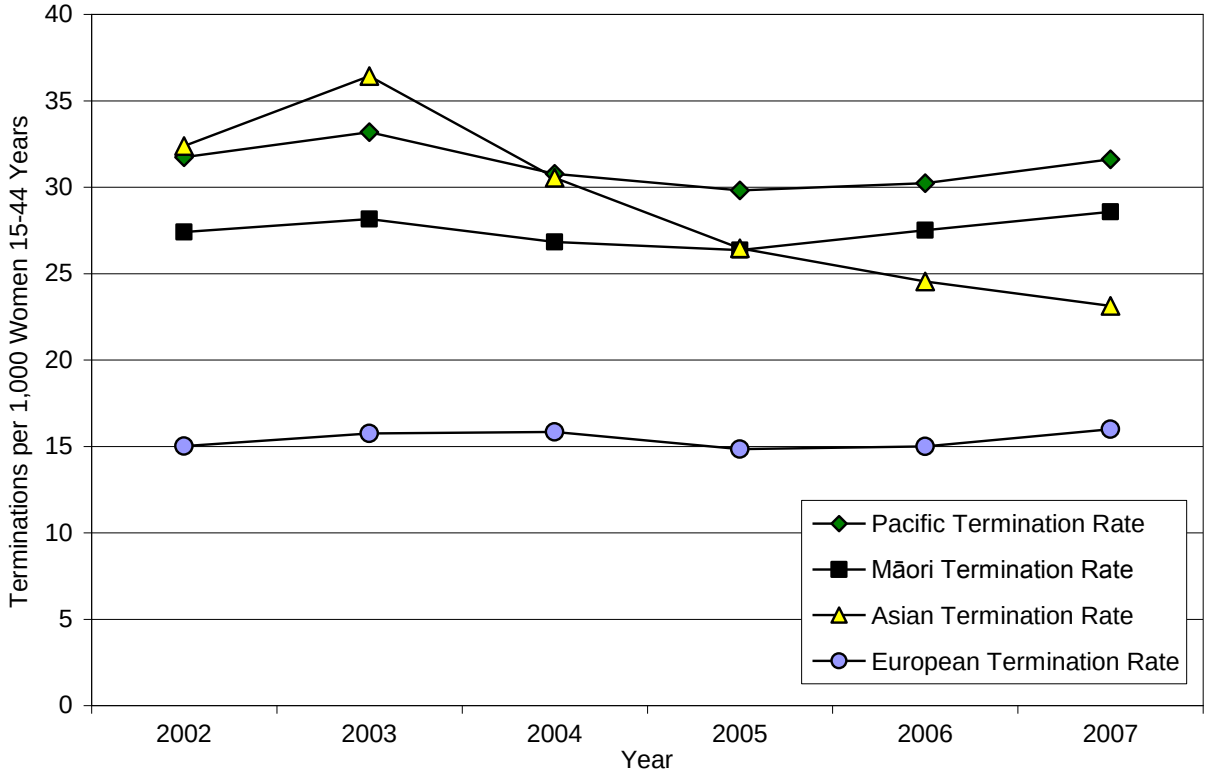
During 2002-2007, termination rates were higher for Pacific, Asian and Māori women than for European women, with termination rates for Asian women declining during this period (**Figure 142**). Ethnic differences in termination rates however, need to be viewed in the context of overall fertility rates, as while Pacific and Māori women had higher termination rates than European women, they also had higher overall fertility during 2007 (**Figure 143**). Once this was taken into account, the overall proportion of terminations to births was higher for Asian women and European women in their teenage years (**Figure 144).**

Figure 141. Terminations of Pregnancy by Age and Ethnicity, New Zealand 2007



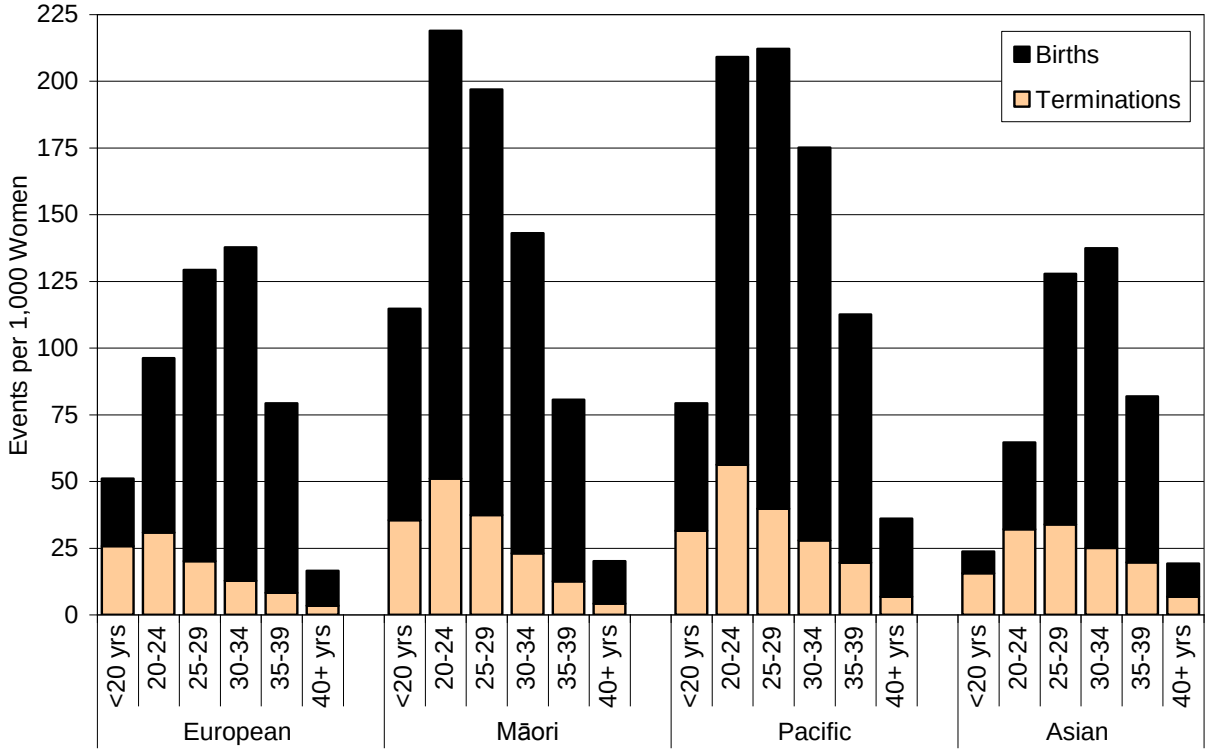
Source: Numerator-Abortion Supervisory Committee (via Statistics NZ); Denominator-Census. Note: Each abortion has been included in every ethnic group specified, thus some abortions are counted more than once. Similarly those identifying with >1 ethnic group have been included in each of the ethnic groups of the denominator.

Figure 142. Terminations of Pregnancy by Ethnicity, New Zealand 2002-2007



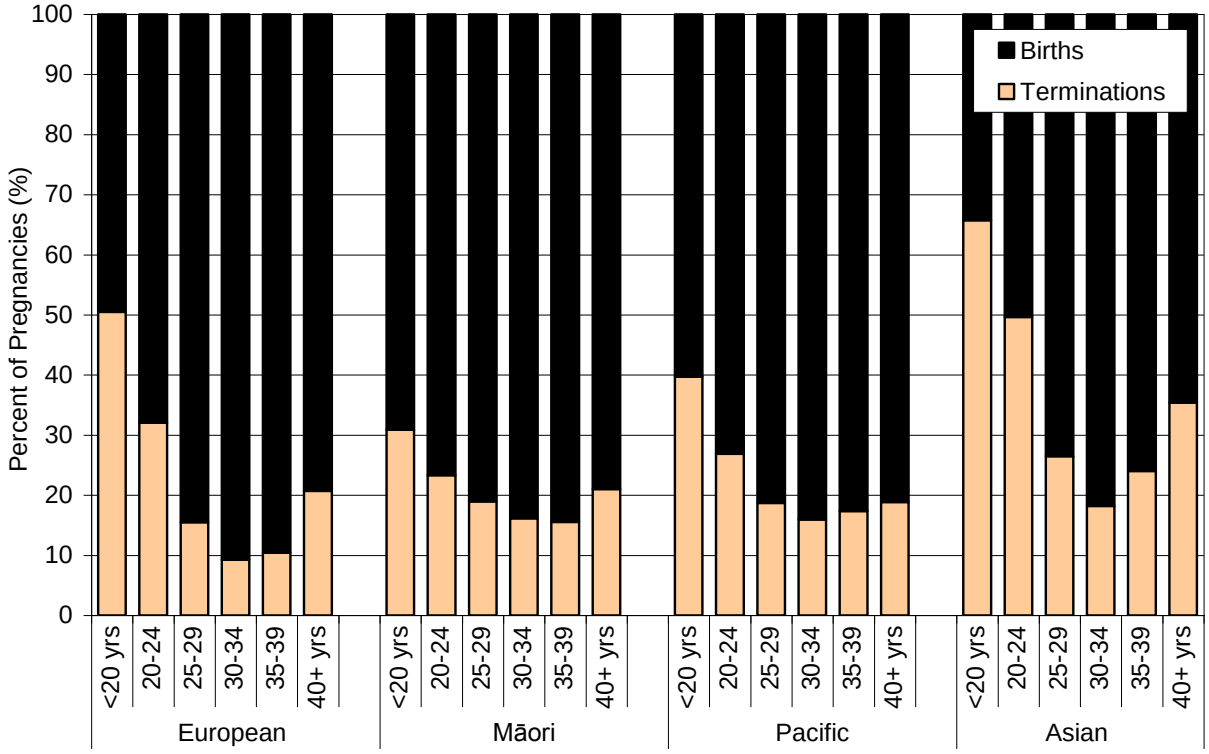
Source: Numerator-Abortion Supervisory Committee (via Statistics NZ); Denominator-Census. Note: Each abortion has been included in every ethnic group specified, thus some abortions are counted more than once. Similarly those identifying with >1 ethnic group have been included in each of the ethnic groups of the denominator.

Figure 143. Birth and Termination of Pregnancy Rates by Age and Ethnicity, New Zealand 2007



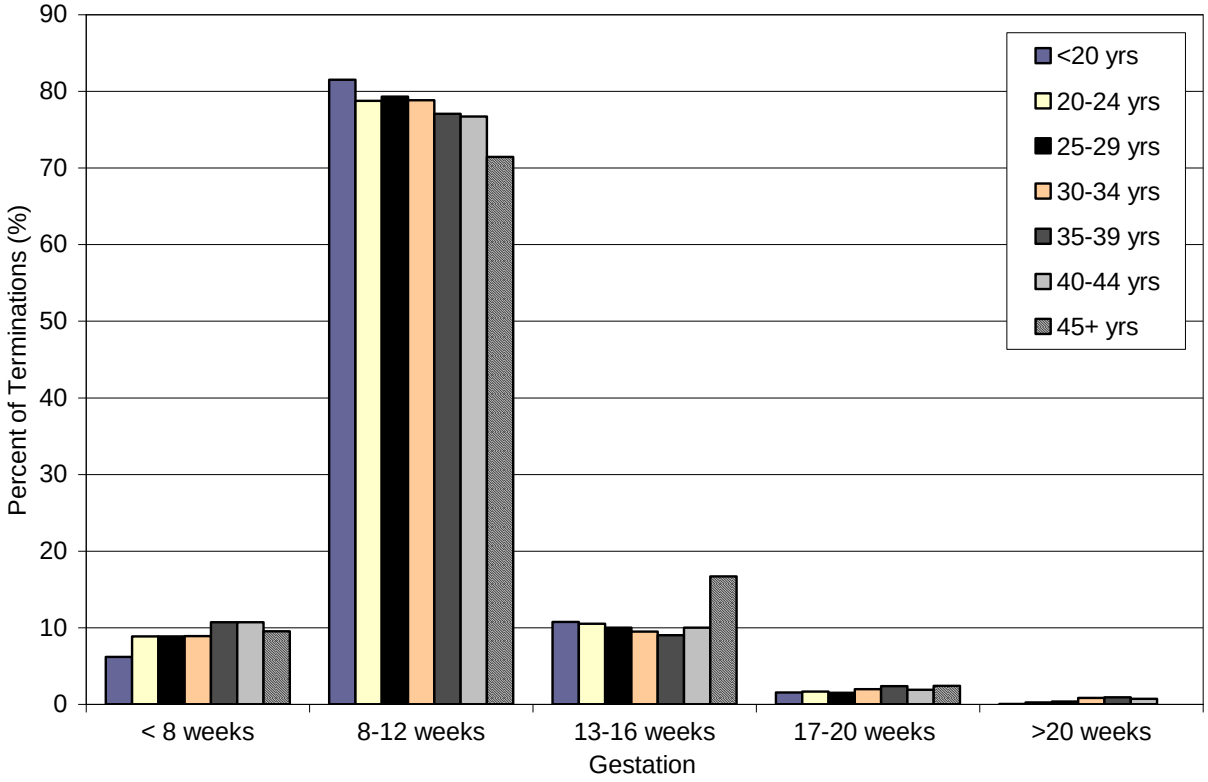
Source: Numerator-Abortion Supervisory Committee (via Statistics NZ) and Birth Registration Dataset; Denominator-Census. Note: Each abortion has been included in every ethnic group specified, thus some abortions are counted more than once. Similarly those identifying with >1 ethnic group have been included in each of the ethnic groups of the denominator.

Figure 144. Terminations and Births as a Proportion of All Pregnancies by Age and Ethnicity, New Zealand 2007



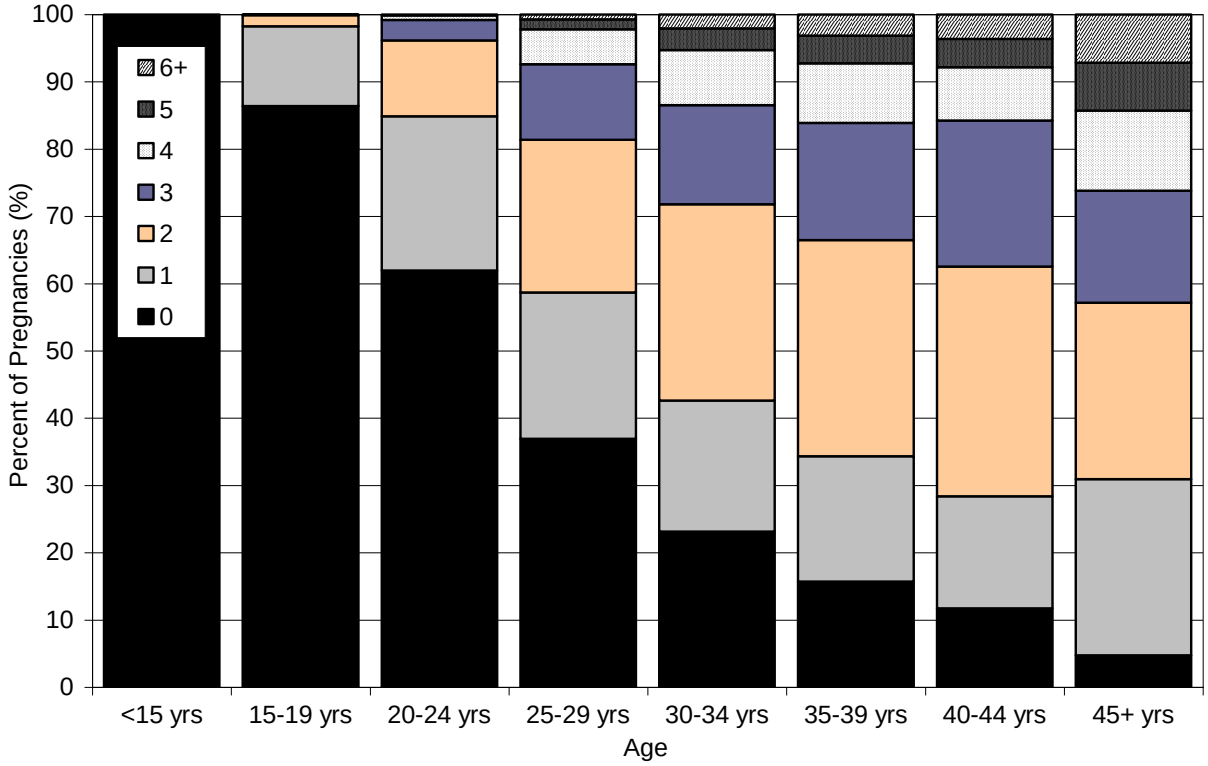
Source: Numerator-Abortion Supervisory Committee (via Statistics NZ) and Birth Registration Dataset; Denominator-Census. Note: Each abortion has been included in every ethnic group specified, thus some abortions

Figure 145. Terminations of Pregnancy by Age and Duration of Gestation, New Zealand 2006



Source: Abortion Supervisory Committee via Statistics New Zealand

Figure 146. Proportion of Women Who Had a Previous Termination by Age and Number of Terminations, New Zealand 2006



Source: Abortion Supervisory Committee via Statistics New Zealand

Distribution by Duration of Gestation and Previous Terminations

During 2006, the majority of terminations occurred at 8-12 weeks gestation, with little evidence to suggest that women in their teenage years were presenting any later than other age groups for a termination of pregnancy (**Figure 145**).

During the same period, the number of women who had experienced a previous termination increased with maternal age, while the proportion with no prior terminations declined, from 100% of those <15 years of age to 4.8% of those aged 45+ years (**Figure 146**).

Regional Distribution and Trends

In New Zealand, the Abortion Supervisory Committee has collected information on the domicile of women seeking terminations since 2004, although the only regional breakdown currently available is by Regional Council. In addition, the Committee has published information for a number of years, on the number of terminations performed in different New Zealand institutions (**Table 110, Table 111**).

Table 110. Distribution of Terminations of Pregnancy by Regional Council (All Age Groups Combined), New Zealand 2004-2007

Regional Council	Number of Terminations				Termination Rate per 1,000 Women Aged 15-44 Years			
	2004	2005	2006	2007	2004	2005	2006	2007
Northland	506	484	494	574	18.04	17.22	17.54	20.34
Auckland	7,238	7,181	7,225	7,299	23.34	22.61	22.22	21.95
Waikato	1,383	1,286	1,472	1,468	17.00	15.67	17.79	17.59
Bay of Plenty	819	756	905	951	16.00	14.66	17.43	18.19
Gisborne	136	142	121	158	14.68	15.40	13.20	17.32
Hawke's Bay	518	561	560	616	17.39	18.79	18.72	20.56
Taranaki	340	317	381	390	16.10	15.05	18.14	18.62
Manawatu-Whanganui	809	801	836	828	17.03	16.95	17.78	17.71
Wellington	2,199	2,160	2,193	2,318	20.73	20.17	20.27	21.22
West Coast	93	98	81	100	15.41	16.22	13.39	16.51
Canterbury	2,135	2,013	2,106	1,992	19.08	17.78	18.40	17.21
Otago	752	687	698	751	16.96	15.37	15.49	16.54
Southland	284	238	290	277	15.06	12.71	15.58	14.98
Tasman	129	158	142	133	15.37	18.80	16.86	15.77
Nelson	196	191	215	216	21.71	21.24	24.00	24.20
Marlborough	109	133	138	164	13.95	16.94	17.49	20.69
New Zealand Total	17,646	17,531	17,934	18,382	19.80	19.44	19.65	19.90

Source: Numerator-Abortion Supervisory Committee (via Statistics New Zealand); Denominator–Census.

Table 111. Distribution of Terminations of Pregnancy by Institution (All Age Groups Combined), New Zealand 2003-2007

Institution	Number of Terminations					Total 2003-07	% of Total
	2003	2004	2005	2006	2007		
Whangarei Area Hospital	454	474	461	461	533	2,383	2.6
National Women's Health		18	105	116	128	367	0.4
Clinical Centre Short Stay	549	537	469	500	474	2,529	2.8
Epsom Day Unit	5,908	5,735	5,543	5,524	5,594	28,304	31.3
Auckland Medical-Aid Trust	1,813	1,647	1,462	1,511	1,592	8,025	8.9
North Shore	10	12	20	26	23	91	0.1
Middlemore	19	38	21	28	20	126	0.1
Brightside	12	11				23	0.0
Rotorua			11	12	13	36	0.0
Thames	505	538	511	535	526	2,615	2.9
Tokoroa	517	553	542	548	549	2,709	3.0
Waikato	1,007	938	967	1,055	1,097	5,064	5.6
Hawke's Bay Hospital	579	539	559	557	613	2,847	3.1
Taranaki Base	263	310	294	358	368	1,593	1.8
Masterton	81	96	131	111	164	583	0.6
Wellington	3,126	3,004	2,882	2,962	3,075	15,049	16.6
Nelson	318	332	344	359	348	1,701	1.9
Wairau	127	123	139	126	160	675	0.8
Ashburton Public	15	12		16	11	54	0.1
Christchurch Women's	365	339	202	108	105	1,119	1.2
Lyndhurst	2,210	2,290	2,242	2,380	2,330	11,452	12.6
Dunedin	607	653	601	626	646	3,133	3.5
Other Hospitals	26	12	25	15	13	91	0.1
New Zealand Total	18,511	18,211	17,531	17,934	18,382	90,569	100.0

Source: Abortion Supervisory Committee (via Statistics NZ). Note: National Women's Health was previously known as Auckland City Hospital; Clinical Short Stay Centre was previously known as National Women's (Greenlane).

Summary

In New Zealand during 1980-2007, terminations of pregnancy increased for all age groups (with the exception of those 11-14 yrs and 45+ yrs). During 2007, terminations were highest for women 20-24 years, followed by those 15-19 and 25-29 years.

During 2002-2007, terminations were higher for Pacific, Asian and Māori women than for European women. Ethnic differences, however, need to be viewed in the context of overall fertility rates, as while Pacific and Māori women had higher termination rates, they also had higher overall fertility. Once this was taken into account, the proportion of terminations to births was higher for Asian women and European women in their teenage years.

Policy Documents and Evidence Based Reviews Relevant to the Prevention of Unintended Pregnancies in Adolescents

There are no Ministry of Health policy documents which focus solely on the prevention of unintended pregnancies in adolescents. A range of policy documents however consider sexual and reproductive health issues more generally, or unintended pregnancies within the wider youth health context. These are described in more detail in **Table 106** on **Page 305**. In addition, a number of international evidence based reviews have considered the most effective approaches to preventing unintended pregnancies in adolescents; these are briefly summarised in **Table 112**.

Table 112. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Unintended Pregnancies in Adolescents

Ministry of Health Policy Documents
There are no Ministry of Health policy documents which focus solely on terminations of pregnancy in young people. A range of policy documents however consider sexual and reproductive health issues more generally, or unintended pregnancies within the wider youth health context (see links above).
Ministry of Health. **Child and Youth Health Toolkit**. 2004, Ministry of Health: Wellington: http://www.MOH.govt.nz/MOH.nsf/by+unid/FBEC1D5276340B65CC257227000FE4D6?Open This Toolkit provides guidance for DHB funders, planners and other professionals on how to improve child health in 10 key areas, one of which is Teenage Pregnancy.
Systematic and Other Reviews from the International Literature
Polis C, Schaffer K, Blanchard K, et al. **Advance Provision of Emergency Contraception for Pregnancy Prevention**. Cochrane Database of Systematic Reviews 2007, Issue 2. This review considered randomised controlled trials (RCTs) evaluating the advance provision of emergency contraception on pregnancy rates, sexually transmitted infections, and sexual and contraceptive behaviours. It found that advance provision of emergency contraception did not reduce pregnancy rates when compared to conventional provision. Advance provision did not negatively impact sexual and reproductive health behaviours and outcomes. The authors concluded that women should have easy access to emergency contraception, because it can decrease the chance of pregnancy. However, the interventions tested thus far have not reduced overall pregnancy rates in the populations studied.
Brindis C. **A Public Health Success: Understanding Policy Changes Related to Teen Sexual Activity and Pregnancy.** Annual Review of Public Health, 2006. 27 (1): p277-C1. This USA focused document reviewed a range of policy interventions aimed at preventing teenage pregnancy including comprehensive family life education (compared to abstinence until marriage); access to reproductive health care and contraceptives; and promoting positive development and life options for young people. The review suggests that such policy approaches have resulted in delays in sexual debut, improved contraceptive use and achieved reductions in pregnancies, abortions and births. The author also notes that such synergistic policy approaches represent a substantial change from previous narrow, single issue strategies (e.g. abstinence or restrictions on contraceptive access) which were limited in their effectiveness.
DiCenso A, Guyatt G, Willan A, Griffith L. **Interventions to Reduce Unintended** Pregnancies **Among Adolescents: Systematic** Review **of Randomised Controlled Trials.** British Medical Journal, 2002. 324 (7351): p1426. This study reviewed the effectiveness of primary prevention strategies aimed at delaying sexual intercourse, improving birth control use, and reducing the incidence of unintended pregnancy in adolescents. It reviewed 26 RCTs and found that the interventions studied did not delay initiation of sexual intercourse; did not improve birth control use at every intercourse, or at last intercourse; and did not reduce pregnancy rates. Four abstinence programmes and one school based sex education programme were associated with an increase in the number of pregnancies among partners of young male participants. While there were significantly fewer pregnancies in young women who received a multifaceted programme, baseline differences in this study favoured the intervention group.
Franklin, C. and J. Corcoran. **Preventing Adolescent Pregnancy: A Review of Programmes and Practices**. Social Work, 2000. 45(1): p. 40-52. This article reviews literature on programmes and practices available for the primary prevention of adolescent pregnancy. Using the outcomes from research studies, the review considers some of the "best practices" available for the purpose of guiding practitioners in their selection of programmes and interventions.

Bennett S, Assefi N. **School-Based Teenage Pregnancy Prevention Programmes: A Systematic Review of Randomised Controlled Trials**. Journal of Adolescent Health, 2005. 36(1): p. 72-81.

This study reviewed all published randomised controlled trials of secondary-school-based teen pregnancy prevention programmes in the US in order to determine whether school-based abstinence-only programmes or programmes including contraceptive information (abstinence-plus) had the greatest impact on teenage pregnancy. The authors concluded that the variability in study populations, interventions, and outcomes of existing school-based trials, and the paucity of studies directly comparing abstinence-only and abstinence plus curricula, precluded definitive conclusions regarding which type of programme is most effective. Nevertheless, the majority of abstinence-plus programmes increased rates of contraceptive use in teens, and one study showed the effects to last for at least 30 months.

Webster G, McCormick G. **Teenage pregnancy and Health Scrutiny. A Briefing Paper**. 2005. Health Development Agency. http://www.nice.org.uk/nicemedia/documents/ teenpreg_healthscrutiny.pdf

This publication focuses on local government scrutiny of teenage pregnancy. It is intended both as a means to inform local teenage pregnancy coordinators about the health scrutiny process, and to assist local authority health overview and scrutiny committees to understand why teenage pregnancy is an issue they need to address. It forms part of the Health Development Agency's work on gathering and disseminating learning from practice. While this paper is very specific to the UK setting it is interesting reading for those developing programmes in the New Zealand setting.

Cheesbrough S, Ingham R, Massey D. **Reducing the Rate of Teenage Conceptions: A Review of the Evidence (US, Canada, Australia & NZ).** 2003, Health Development Agency. http://www.nice.org.uk/nicemedia/documents/teenconcep_revise_v3.pdf

This review considers the international evidence on preventing and reducing teenage pregnancy in the US, Canada, Australia, and New Zealand. It recommends that policy initiatives should focus on tackling the root causes of social dislocation and low aspirations that lead to higher levels of teenage pregnancy, by targeting educational opportunities and aspirations from pre-primary age onwards. For teenagers, programmes that improve young people's knowledge and access to contraceptive services do not in themselves increase levels of sexual activity and will improve effective contraception use.

Franklin C, Grant D, Corcoran J, et al. **Effectiveness of** Prevention **Programmes for Adolescent** Pregnancy**: A** Meta**-**Analysis**.** Journal of Marriage & Family, 1997. 59 (3) p551-567.

Using meta-analysis, the authors examined 32 outcome studies on the primary prevention of adolescent pregnancy. Three outcomes: sexual activity, contraceptive use and pregnancy rates were analysed. The results indicated that the pregnancy prevention programmes which were examined had no effect on the sexual activity of adolescents. Sufficient evidence was found to support the efficacy of pregnancy prevention programmes for increasing use of contraceptives. A smaller but significant amount of evidence supported programme effectiveness in reducing pregnancy rates.

DiCenso A. **School-Based Sex Education Linked To Access To Contraceptive Services May Reduce Teenage Pregnancy**. Evidence-Based Medicine, 1997. 2(Sept-Oct):150.

This review included 42 studies which evaluated the effectiveness of educational programmes in reducing teenage pregnancy (15 were randomised controlled trials). The authors found that sex and contraceptive education within the school setting did not lead to increased sexual activity or incidence of pregnancy. The provision of clear information about contraceptive methods appeared important to the success of school-based programmes. The few studies that have shown a reduction in teenage pregnancy (none of which were randomised controlled trials) provided multifaceted programmes with links to contraceptive services or work experience. The authors concluded that school-based sex education can be effective in reducing teenage pregnancy, especially when linked to access to contraceptive services. They also noted that programmes promoting access to antenatal care, educational opportunities, and targeted support by health visitors improved the health and development of teenage mothers and their children.

Forthcoming Publications

National Institute for Health and Clinical Excellence. **Guidance on the provision of contraceptive services in appropriate settings for socially disadvantaged young people (up to the age of twenty five).** This guidance document is currently being developed by NICE and is expected to be published in 2010.

Ehiri J, Meremikwu A, Meremikwu M. **Interventions for Preventing Unintended Pregnancies Among Adolescents** (Protocol). Cochrane Database of Systematic Reviews (Cochrane Fertility Regulation Group) 2008

This review, which is currently underway, aims to assess the effects of primary prevention interventions (school-based, community/home-based, clinic-based, and faith-based) on unintended pregnancies among adolescents.

Sexually Transmitted Infections

Introduction

Sexually transmitted infections (STIs) are one of the leading causes of preventable illness in New Zealand young people [271]. Untreated they can have long term consequences including an increased risk of infertility, sub-fertility, ectopic pregnancy and cancer. In addition, the presence of a STI can increase the risk of HIV transmission that, if untreated, may be passed on by a mother to her baby at the time of birth [271].

In New Zealand, research suggests that 10-30% of young people have had sexual intercourse by the time they reach 15 years of age, with the figure increasing to over 50% by 16-17 years [249]. Factors associated with early sexual intercourse include female gender, a background of socioeconomic disadvantage, sexual abuse in childhood and alcohol misuse in early adolescence [249]. Sexually transmitted infections are also relatively common amongst those 15-24 years, with chlamydia being the most frequently diagnosed STI, followed by genital warts, non specific urethritis, genital herpes and gonorrhoea (see text box below) [282]. While chlamydia and gonorrhoea are more common amongst Māori and Pacific groups, viral conditions (e.g. genital warts and herpes) are more common amongst Europeans [249].

Sexually Transmitted Infections Most Commonly Diagnosed in NZ Young People

Chlamydia: Caused by the organism *Chlamydia trachomatis.* Infection may be asymptomatic in 70% of females and 50% of males. Untreated, chlamydia can lead to pelvic inflammatory disease (PID), ectopic pregnancy and infertility in females and urethritis, epididymo-orchitis, arthritis and infertility in males. Infection can also be transmitted to infants at the time of birth, leading to conjunctivitis and pneumonia [283].

Gonorrhoea: Caused by the organism *Neisseria gonorrhoea*. Infection may be asymptomatic in 50% of females and 10% of males. Untreated, gonorrhoea can lead to PID in females, epididymo-orchitis in males and severe conjunctivitis in neonates [283].

Genital Herpes: Caused by *Herpes simplex* virus (HSV) Type 1 or 2. Infections are associated with painful vesicular eruptions/ulcerations of genital skin and mucus membranes, which may become recurrent. Vaginal delivery in pregnant women with active infection may lead to infection of the newborn, resulting in severe systemic disease [283].

Genital Warts: Caused by infection with the human papillomavirus (HPV), which leads to the formation of small, soft, pink growths on the genitals which may become pedunculated. Warts may be solitary or cauliflower like and are generally painless [202]. Infection may be with types 6 and 11, or with the more high risk types 16 and 18, which are associated with a higher risk of cervical cancer [283].

In New Zealand, reliable time series information on the incidence of STIs is currently unavailable. What information is available however, is collated by the ESR, who receive notifications from sexual health, family planning and student health clinics (chlamydia, gonorrhoea, genital herpes, genital warts, infectious syphilis, non-specific urethritis (males), chancroid, granuloma inguinale, lymphogranuloma venerium) and some laboratories (chlamydia, gonorrhoea) [270]. As reporting is voluntary, as not all clinics and laboratories report to ESR on a regular basis, and as other practitioners (e.g. GPs) also may treat young people with STIs, coverage remains incomplete. Nevertheless the available evidence (from laboratories reporting consistently over a number of years) suggests that both chlamydia and gonorrhoea have increased in New Zealand in recent years [282].

The following section uses information from the ESR to explore trends in chlamydia and gonorrhoea in New Zealand young people. Because laboratory based surveillance data does not include information on ethnicity, it is very difficult to obtain ethnic specific rates for common sexually transmitted infections (while sexual health clinics do report on STIs by ethnicity, the lack of an appropriate denominator precludes the calculation of rates). Despite these limitations, the available evidence would suggest that STIs are as much an issue for Pacific young people in New Zealand as they are for other ethnic groups and the trends highlighted in this section need to be interpreted with this in mind. Policy and evidence based review documents which consider how STIs might be addressed at the population level are considered at the end of this section.

Data Source and Methods

Definition

1. Laboratory Based Notifications for Chlamydia and Gonorrhoea in Young People Aged < 25 Years
2. Clinic Based Notifications for Chlamydia, Gonorrhoea, Genital Herpes and Genital Warts for Young People Aged <25 Years Data Source and Interpretation

Notes on Interpretation

Note 1: The information on sexually transmitted infections (STIs) in this analysis was obtained from the ESR's Annual Surveillance Reports [270] and is based on information from their laboratory based surveillance systems. While a number of sexual health and family planning clinics also report voluntarily to ESR regarding the numbers of STIs seen, a lack of a clearly defined denominator means that it is impossible to estimate population prevalence from the information provided. In addition, because other practitioners within the primary care setting also treat young people for STIs, the figures given cannot be taken as representative of the total population. Laboratory based reporting however is also undertaken in a number of regions (Auckland, Waikato, Bay of Plenty), and because these laboratory's have clearly defined catchment areas, it is possible to estimate rates for chlamydia and gonorrhoea for these particular populations.

Note 2: Tests of statistical significance have not been applied to the data in this section, and thus any associations described do not imply statistical significance or non-significance.

Indicator Category

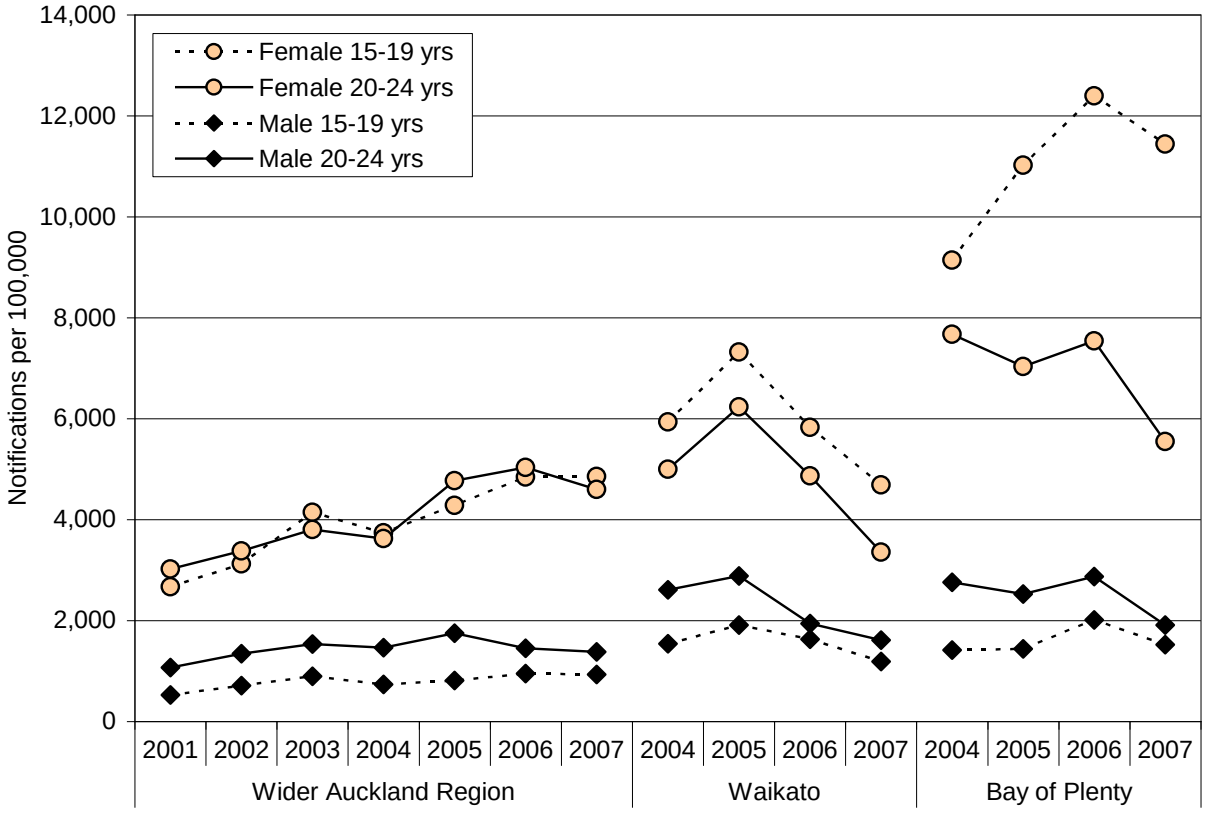
Bookmark C

New Zealand Distribution and Trends

Chlamydia

Laboratory notification data from the Auckland, Waikato and Bay of Plenty regions during 2001-2007 suggested that chlamydia infections in these regions were more common in females than males. While for females, chlamydia was more common in the 15-19 year old age group, for males infections were more common in those aged 20-24 years. In addition, while there were large regional variations in chlamydia notifications during this period, in two out of the three regions studied, notifications exhibited a general upward trend, which begun to taper off during 2007 (**Figure 147**).

Figure 147. Laboratory Notifications for Chlamydia in Young People 15-24 Years, Selected New Zealand Regions 2001-2007

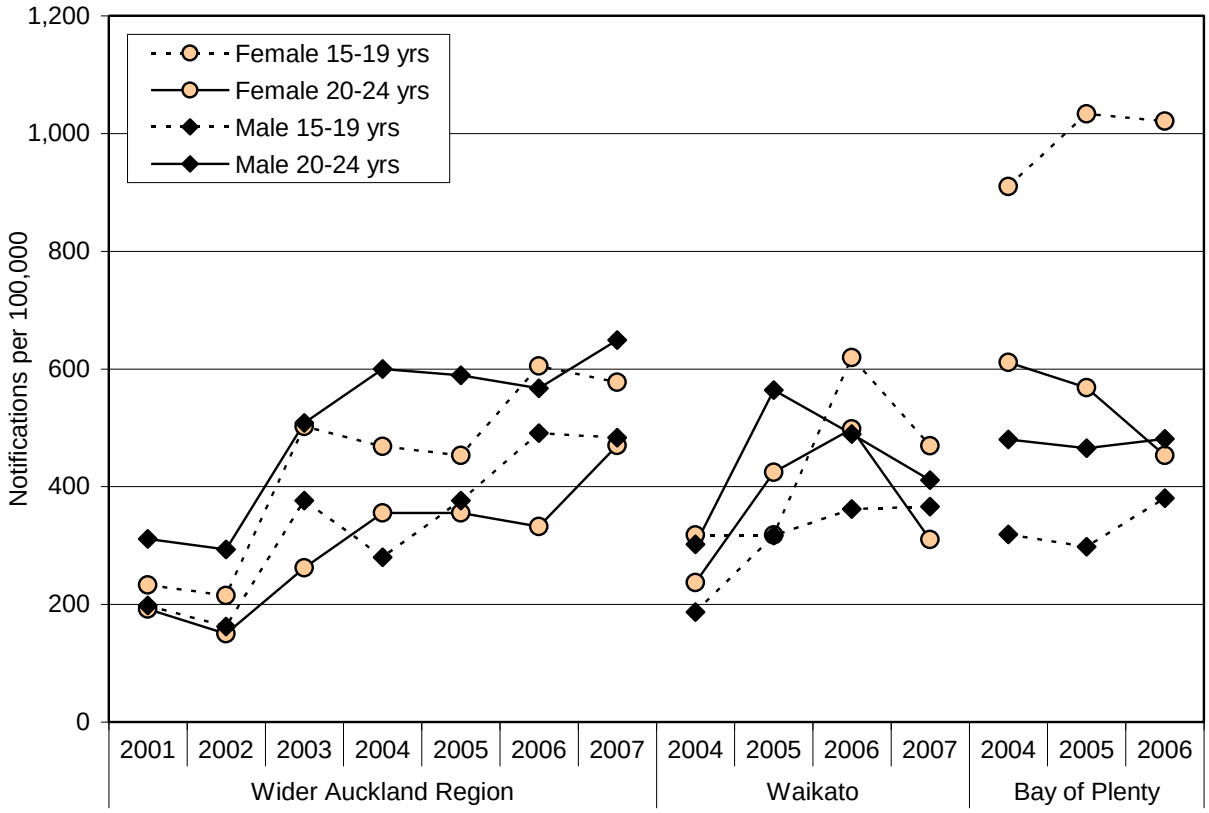


Source: ESR

Gonorrhoea

During the same period, while gonorrhoea infections were much less common than chlamydia amongst those aged <25 years, in two out of the three regions studied gonorrhoea rates also exhibited a general upwards trend (although rates in one of these regions tapered off in 2007). Gender and age differences however, were much less marked than they were for chlamydia (**Figure 148**).

Figure 148. Laboratory Notifications for Gonorrhoea in Young People 15-24 Years, Selected New Zealand Regions 2001-2007



Source: ESR

Summary

National laboratory based surveillance during 2001-2007 suggests that chlamydia and gonorrhoea were both relatively common infections amongst those aged <25 years and that rates for both conditions were exhibiting a general upward trend. This is of concern, as STIs can lead to the development of serious sequelae such as pelvic inflammatory disease, ectopic pregnancy and infertility, as well as facilitating the transmission of HIV. While data limitations meant that reliable ethnic specific rates could not be calculated, the available evidence would suggest that STIs are as much of an issue for Pacific young people in New Zealand as they are for other ethnic groups.

Policy Documents and Evidence Based Reviews Relevant to the Prevention of Sexually Transmitted Infections

There are no Ministry of Health policy documents which focus solely on sexually transmitted infections in young people. A range of policy documents however address sexual and reproductive health issues more generally, or consider sexually transmitted infections within the wider youth health context. These are described in more detail in **Table 106** on **Page 305**. In addition, a number of international evidence based reviews considered the most effective approaches to preventing sexually transmitted infections in adolescents, and these are briefly summarised in **Table 113**.

Table 113. Policy and Evidence Based Review Documents Which Consider Population Level Approaches to Sexually Transmitted Infections

Ministry of Health Policy Documents
There are no Ministry of Health policy documents which focus solely on sexually transmitted infections (STIs) in young people. A range of policy documents however address sexual and reproductive health issues more generally, or consider STIs within the wider youth health context (see links on previous page)
Ministry of Health. **The HPV (Human Papillomavirus) Immunisation Programme. National Implementation Strategy Overview.** 2008, Ministry of Health; Wellington. This document outlines the Ministry of Health's plan for implementing the HPV Immunisation Programme. From 1 Sept. 2008, all girls born in 1990 and 1991 will be eligible for the vaccine delivered by their primary healthcare provider. A school based catch-up programme will be phased in over 2009 and 2010, with the programme in 2009 being rolled out for girls in Year 8 (or age 12 if not delivered in a school-based programme). DHBs are expected to provide leadership in implementing the programme and are required to prepare a local implementation plan within a nationally consistent framework, with a focus on achieving equity for their populations. It is recommended that the majority of girls and young women be offered immunisation through school-based programmes to optimise coverage and reduce inequalities. Specific strategies will be required to ensure equitable coverage for Māori and Pacific girls.
Systematic and Other Reviews from the International Literature
Barham L. Lewis D. Latimer N. **One-to-One Interventions to Reduce Sexually Transmitted Infections and Under the Age of 18 Conceptions: A Systematic Review of the Economic Evaluations**. Sexually Transmitted Infections, 2007. 83(6):441-6. This review critically appraised economic evaluations of one-to-one interventions to reduce sexually transmitted infections (STIs) and teenage conceptions. The authors identified 3,190 papers and of these 55 were included. The majority found one-to-one interventions to be either cost saving or cost effective, although one highlighted the need to target the population receiving post-exposure prophylaxis to reduce transmission of HIV. The authors felt that most studies used a static approach that ignored the potential re-infection of treated patients and concluded that one-to-one interventions may be cost saving or cost effective but there are some limitations when applying this evidence to the policy context.
Manhart L. Holmes K. **Randomised Controlled Trials of Individual-Level, Population-Level, and Multilevel Interventions for Preventing Sexually Transmitted Infections: What Has Worked?** Journal of Infectious Diseases, 2005. 191(Suppl 1):S7-24. This review evaluated interventions for preventing the acquisition, transmission or complications of sexually transmitted infections (STI). All types of intervention at the individual, group and community level were eligible for inclusion. Interventions were classified as behaviour change, vaccination, use of topical microbicides, and prophylactic, curative or suppressive therapy. Of the 41 included randomised controlled trials, 22 showed a significant positive effect of the intervention. Interventions showing a positive effect in more than one study included group counselling and skills building, hepatitis B vaccine, nonoxynol-9 and prophylactic microbicide treatment to prevent acquisition, and partner treatment to prevent transmission. Only one intervention (syndromic treatment of STIs) showed a positive effect in reducing the sexual transmission of HIV. The authors concluded that many interventions are effective against STIs but few have been widely implemented or evaluated in a range of settings. (Note: the authors searched a relatively narrow range of sources in English only, so relevant studies may have been missed).

Ellis S, Grey A.. **Prevention of Sexually Transmitted Infections (STIs): A Review of Reviews into the Effectiveness of Non-Clinical Interventions. Evidence Briefing.** 2004. Health Development Agency. http://www.nice.org.uk/nicemedia/documents/prevention_stis_evidence_briefing.pdf

This evidence briefing is a review of reviews which consider the effectiveness of interventions that impact on the determinants (both personal and structural) which influence the risk of sexually transmitted infections (STIs).

Shepherd J, Weston R, Peersman G, et al. **Interventions for Encouraging Sexual Lifestyles and Behaviours Intended to Prevent Cervical Cancer.** Cochrane Database of Systematic Reviews 1999, Issue 4.

This review considered the effectiveness of health education interventions to promote sexual risk reduction behaviours amongst women in order to reduce transmission of HPV. The authors concluded that educational interventions targeting socially and economically disadvantaged women in which information provision is complemented by sexual negotiation skill development can encourage at least short-term sexual risk reduction behaviour. The authors believe this has the potential to reduce the transmission of HPV, thus possibly reduce the incidence of cervical carcinoma.

Kirby D, Short L, Collins J, et al. **School-Based Programmes to Reduce Sexual Risk Behaviours: A Review of Effectiveness**. Public Health Reports, 1994. 109(3):339-360.

This review synthesised, in a qualitative way, research on the effectiveness of school-based programmes to reduce sexual risk behaviours, to identify the distinguishing characteristics of effective programmes and also to identify important research questions to be addressed in the future. The review included 23 studies (6 experimental, 10 quasi-experimental studies that evaluated impact, and 7 national surveys). The authors concluded that the programmes reviewed did not hasten intercourse in older students, while evidence for younger students was less consistent. Some programmes can increase the use of condoms or other contraceptives. The curricula that effectively delayed the onset of intercourse, increased the use of condoms or contraception, and reduced sexual risk behaviours had 6 common characteristics listed by the authors. The published literature does not provide good evidence to indicate that programmes focusing only on abstinence delay the onset of intercourse or reduce the frequency of intercourse. The authors felt there is insufficient direct evidence to determine whether any of these educational or clinic programmes actually decreased pregnancy rates, birth rates, or incidence of STD or HIV infections. There was however evidence from 2 studies that some programmes delayed the onset of intercourse, reduced the number of sexual partners, and reduced the frequency of intercourse or increased the use of protection.

Other Relevant Publications

Kamb M, Fishbein M, Douglas J, et al., for the Project RESPECT Study Group. **Efficacy of Risk-Reduction Counselling to Prevent Human Immunodeficiency Virus and Sexually Transmitted Diseases. A Randomised Controlled Trial.** Journal of the American Medical Association, 1998. 280:1161-7.

This trial considered whether counselling reduces high-risk sexual behaviour and prevents new STDs in persons attending sexually transmitted disease (STD) clinics. The trial included 5758 participants ≥14 years of age who attended a STD clinic for examination, and agreed to an HIV test. Participants were allocated to enhanced counselling (4 sessions); brief counselling (2 sessions); didactic messages (2 sessions) about HIV and STD prevention; or didactic messages with no follow-up sessions scheduled after the intervention. The authors concluded that enhanced or brief counselling led to fewer new STDs than didactic messages at 6 months and at 12 months. The enhanced and brief counselling groups had similar cumulative incidences of STDs. The authors concluded that 2 or 4 sessions of interactive counselling were effective in reducing new STDs in persons attending STD clinics.

DEMOGRAPHY AND THE MEASUREMENT OF ETHNICITY

The Measurement of Ethnicity

Introduction

In New Zealand during 2003-2007 a total of 45,622 babies were born who were identified as belonging to a Pacific Island group. Of these babies, 43.6% identified solely with one Pacific group, while a further 8.3% identified simultaneously with 2+ Pacific groups. In addition, 12.2% also identified as Māori, 12.0% as European and 1.8% as Asian / Indian / Other, with the remaining 22.1% identifying with 3 ethnic groups, of which at least one was Pacific (**Figure 149**).

While these figures reflect the ethnic diversity of New Zealand's population today, they also pose a number of challenges for anyone attempting to review the health status of New Zealand's Pacific children and young people. In particular, they highlight the potential for ethnic disparities in health outcome to change depending on the ethnicity definitions used, as well as the need for robust methodologies for the collection and classification of ethnicity information.

This section thus briefly outlines how information on ethnicity has been collected within the New Zealand health sector over the past two decades, before reviewing the systems used to classify ethnicity in the context of this report. A following section then provides a brief overview of the demographic profile of Pacific children and young people in New Zealand, using these definitions and information available from the Birth Registration Dataset and 1996-2006 Censuses.

The Classification of Ethnicity in New Zealand's National Data Collections: A Historical Perspective

The majority of the rates calculated in this report have relied on the division of numerators (e.g. hospital admissions, mortality data) by Statistics New Zealand Census denominators. Calculation of accurate ethic specific rates relies on the assumption that information on ethnicity is collected in a similar manner in both the numerator and denominator datasets and that a single child will be identified similarly in each. In New Zealand this has not always been the case, and in addition the manner of collecting information on ethnicity has varied significantly over time. Since 1996 however, there has been a move to ensure that ethnicity information is collected in a similar manner across all administrative datasets in New Zealand (Census, Hospital Admission, Mortality, Births) [284]. The following section briefly reviews how information on ethnicity has been collected in national data collections since the early 1980s and the implications of this for the information contained in this report.

1981 Census and Health Sector Definitions

Earlier definitions of ethnicity in official statistics relied on the concept of fractions of descent, with the 1981 census asking people to decide whether they were fully of one ethnic origin (e.g. Full Pacific, Full Māori) or if of more than one origin, what fraction of that ethnic group they identified with (e.g. 7/8 Pacific + 1/8 Māori). When prioritisation was required, those with >50% of Pacific or Māori blood were deemed to meet the ethnic group criteria of the time [285]. A similar approach was used to record ethnicity in health sector statistics, with birth and death registration forms asking the degree of Pacific or Māori blood of the parents of a newborn baby / deceased individual. For hospital admissions, ancestry based definitions were also used during the early 80s, with admission officers often assuming ethnicity, or leaving the question blank [286].

1986 Census and Health Sector Definitions

Following a review expressing concern at the relevance of basing ethnicity on "fractions of descent", a recommendation was made to move towards self-identified cultural affiliation. Thus the 1986 Census asked the question "What is your ethnic origin?" and people were asked to tick the box(s) that applied to them. Birth and death registration forms however, continued to use the "fractions of blood" question until 1995, making comparable numerator and denominator data difficult to obtain [285]. For hospital admissions, the move from an ancestry based to a self-identified definition of ethnicity began in the mid-80s, although non-standard forms were used and typically allowed a single ethnicity only [286].

1991 Census and Health Sector Definitions

A review suggested that the 1986 ethnicity question was unclear as to whether it was measuring ancestry or cultural affiliation, so the 1991 Census asked two questions:

1. Which ethnic group do you belong to? (tick the box or boxes which apply to you)
2. Have you any NZ Māori ancestry? (if yes, what iwi do you belong to?)

As indicated above however, birth and death registrations continued with ancestry based definitions of ethnicity during this period, while a number of hospitals were beginning to use self-identified definitions in a non standard manner [286].

1996 Census and Health Sector Definitions

While the concepts and definitions remained the same as for the 1991 census, the ethnicity question in the 1996 Census differed in that:

1. The NZ Māori category was moved to the top of the ethnic categories
2. The 1996 question made it more explicit that people could tick more than 1 box.
3. There was a new "Other European" category with 6 sub groups

As a result of these changes, there was a large increase in the number of multiple responses, as well as an increase in the Māori ethnic group in the 1996 Census [285]. Within the health sector however, there were much larger changes in the way in which ethnicity information was collected. From late 1995, birth and death registration forms incorporated a new ethnicity question identical to that in the 1996 Census, allowing for an expansion of the number of ethnic groups counted (previously only Māori and Pacific) and resulting in a large increase in the proportion of Pacific and Māori births and deaths recorded. From July 1996 onwards, all hospitals were also required to inquire about ethnicity in a standardised way, with a question that was compatible with the 1996 Census and that allowed multiple ethnic affiliations [286]. A random audit of hospital admission forms conducted by Statistics NZ in 1999 however, indicated that the standard ethnicity question had not yet been implemented by many hospitals. In addition, an assessment of hospital admissions by ethnicity over time showed no large increases in the proportions of Māori and Pacific admissions after the 1996 "change over", as had occurred for birth and death statistics, potentially suggesting that the change to a standard form allowing for multiple ethnic affiliations in fact did not occur. Similarities in the number of people reporting a "sole" ethnic group pre and post 1996 also suggest that the way in which information on multiple ethnic affiliations was collected did not change either. Thus while the quality of information available since 1996 has been much greater than that previously, there remains some concern that hospitals continue to undercount multiple ethnic identifications and as a result, may continue to undercount Pacific and Māori peoples [286].

2001 Census and Health Sector Definitions

The 2001 Census reverted back to the wording used in the 1991 Census after a review showed that this question provided a better measure of ethnicity based on the current statistical standard [285]. The health sector also continued to use self-identified definitions of ethnicity during this period, with the *Ethnicity Data Protocols for the Health and Disability Sector* [284] providing guidelines which ensured that the information collected across the sector was consistent with the wording of the 2001 Census (i.e. *Which ethnic groups do you belong to (Mark the space or spaces that apply to you)?)*

2006 Census Questions

The 2006 Census used identical wording to the 2001 Census. Within the "Other" ethnic group however, a new category was created which allowed for the responses of those identifying as a "New Zealander". In previous years this sub-category had been assigned to the European ethnic group. At the 2006 Census, a total of 429,429 individuals (10.6% of the NZ population) identified themselves as a New Zealander, a large increase from previous years and a trend, which if continued, may seriously impair the health sector's ability to source consistent ethnic specific denominators for use with its administrative datasets. As yet the consequences of this change have not been fully addressed by the health sector and in this report, where prioritised ethnicity has been used, 2006 Census data has combined the New Zealander category with the European category, as per the protocol in previous censuses.

The Current Recording of Ethnicity in New Zealand's National Datasets

In New Zealand at present, only 3 ethnic groups are stored electronically in the National Minimum (Hospital Admission) Dataset and Mortality Collection (although evidence suggests that <0.5% of National Health Index Database entries have 3 ethnicities recorded [284]). Within these datasets, each

ethnic group is coded using Statistics New Zealand's 4 Level Hierarchical Classification System as follows:

1. Level 1 (least detailed level) e.g. code 3 is Pacific
2. Level 2 e.g. code 37 is Other Pacific Peoples
3. Level 3 e.g. code 371 is Other Pacific Peoples
4. Level 4 (most detailed level) e.g. code 37124 is Kiribati

For those reporting multiple ethnic affiliations, a single "Level 1 Prioritised" Ethnic Group can be assigned using Statistics New Zealand's prioritisation algorithms, which assign Māori ethnicity precedence over Pacific > Asian > Other > European ethnic groups [284]. This ensures that each individual is counted only once and that the sum of the ethnic groups equals the total NZ population [286]. The implication of prioritisation for Pacific groups however, is that outcomes for those identifying as both Māori and Pacific are only recorded under the Māori ethnic group.

The Ethnicity Classifications Used in this Report

Because of the inconsistencies in the way in which ethnicity information was collected prior to 1996, all of the ethnic specific analyses in this report are based on data collected since this period. While all of the classification systems used are based on self-identified concepts of ethnicity and are derived from information stored in New Zealand's national data collections, each differs in the way in which it deals with children and young people with multiple ethnic affiliations:

1. Prioritised Level 1 Ethnicity: Where comparisons with other ethnic groups are required, this report utilises Statistics NZ's Level 1 Prioritised Ethnicity, which recognises 5 ethnic groups: European, Māori, Pacific Island, Asian (including Indian) and Other. For those reporting multiple ethnic affiliations, ethnicity is prioritised in the following order: Māori > Pacific > Asian > Other > European, so that each child or young person is only assigned to a single ethnic group [284]. While convenient for the purposes of analysis, this process results in the loss of a small but significant proportion of Pacific children and young people to the Māori ethnic group (in both the numerator and the denominator).
2. Any Pacific: Where a Pacific focused analysis is required which seeks to incorporate the ethnic heterogeneity of New Zealand's Pacific population, this report utilises the Any Pacific classification, which includes all children and young people identifying as Pacific in ANY of their first three ethnic groups. This classification system has the advantage of including anyone identifying as Pacific in the broader sense and in addition, provides a larger and more stable numerator and denominator for statistical analysis. Because the Any Pacific group includes a large number with multiple ethnic affiliations however, health disparities for those in the Any Pacific Group tend to be less than for those in the Sole Pacific Category. In addition, due to the possibility that a single individual may appear in more than one Any Pacific category when a Level 2 (e.g. Samoan, Tongan) analysis is undertaken, outcomes for Level 2 Any Pacific groups cannot be directly added to produce an overall Any Pacific total. (Note: This classification system is often referred to as *Total Response* in other Ministry of Health Publications).
3. Sole Pacific: Where a Pacific focused analysis is required which seeks to discount the ethnic heterogeneity of New Zealand's Pacific population, this report utilises a Sole Pacific classification, which includes only those identifying solely with one Pacific Island group. This system results in greater homogeneity, as there is no admixture with other ethnic groups, and health disparities tend to be greater than if the Any classification system is used. The Sole Pacific classification results in a much smaller and statistically less stable numerator and denominator however and in addition, potentially fails to take into account the ethnic diversity of New Zealand's Pacific child and youth population.

One or all of above classification systems have been utilised in this report wherever the analysis of primary data was undertaken by the authors.

Pacific Children & Young People in New Zealand: Demographic Profile

Having considered the ways in which ethnicity has been classified in this report this section provides a brief overview of the demographic profile of Pacific children and young people in New Zealand using information available from the Birth Registration Dataset and the 1996-2006 Censuses. The information serves to highlight both the significant heterogeneity and relative youth of the Pacific population in New Zealand, as well as the disproportionate overrepresentation of Pacific children and young people in New Zealand's most deprived (NZ Deprivation Index decile 10) areas.

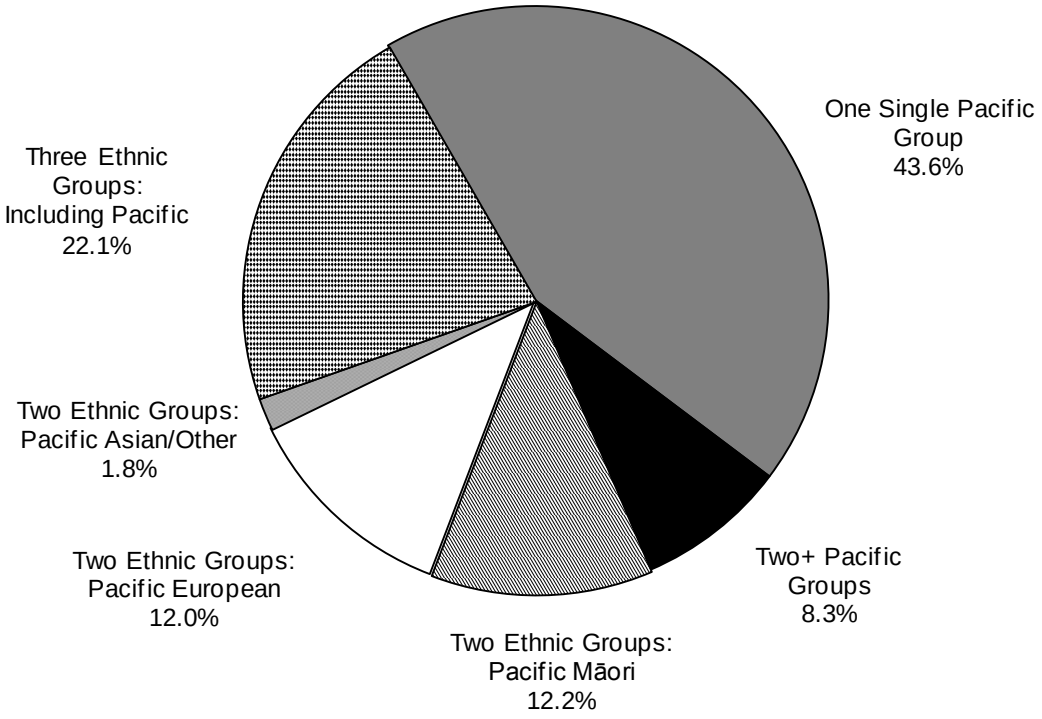
Data Sources and Methods

Data Sources
Birth Registration Dataset and 1996, 2001 and 2006 Censuses
Statistical Significance Testing
Tests of statistical significance have not been applied to the data in this section, and thus any associations described do not imply statistical significance or non-significance (see Appendix 1 for rationale).

Birth Registrations

As highlighted previously, in New Zealand during 2003-2007 a total of 45,622 babies were born who were identified as belonging to a Pacific Island group. Of these babies, 43.6% identified solely with one Pacific group, while a further 8.3% identified simultaneously with 2+ Pacific groups. In addition, 12.2% also identified as Māori, 12.0% as European and 1.8% as Asian / Indian / Other, with the remaining 22.1% identifying with 3 ethnic groups, of which at least one was Pacific (**Figure 149**).

Figure 149. Breakdown of Pacific Births by Ethnic Group, New Zealand 2003-2007



Source: Birth Registration Dataset. Note: Includes all births where a Pacific ethnicity was recorded in the first three ethnic groups

When attempting to quantify the proportion of babies born in New Zealand each year who are of Pacific Island origin, the final estimate is very much dependant on the ethnicity classification used. While an analysis using prioritised ethnicity would suggest that during 2007 Pacific babies accounted for just under 11% of births each year, the same analysis using the Sole Pacific classification yields a figure of 6.6%. In addition, while an analysis using either of these classifications suggests that the overall proportion of Pacific births in New Zealand each year has not changed appreciably, an analysis using the Any Pacific classification suggests that the proportion may be increasing, with the widening disparity in numbers between the Any and Sole categories potentially suggesting either that the ethnic heterogeneity of the Pacific population is increasing, or that Pacific Island parents are increasingly more likely to identify multiple ethnic groups on their baby's birth registration forms (**Table 114**).

Table 114. Proportion of Pacific Births Using Three Different Ethnicity Classifications, New Zealand 1996-2007

Year	Prioritised Pacific		Any Pacific		Sole Pacific		NZ Total
	Number	% of Births	Number	% of Births	Number	% of Births	Number
1996	5,760	10.0	7,670	13.3	3,896	6.7	57,817
1997	5,740	9.9	7,695	13.2	3,795	6.5	58,100
1998	5,251	9.4	7,068	12.7	3,410	6.1	55,849
1999	6,284	10.9	8,363	14.5	4,162	7.2	57,807
2000	6,190	10.8	8,369	14.6	4,046	7.1	57,345
2001	6,164	10.9	8,393	14.8	3,924	6.9	56,552
2002	6,031	11.0	8,231	15.0	3,845	7.0	54,870
2003	6,187	10.9	8,470	14.9	3,844	6.8	56,925
2004	6,421	10.8	8,925	15.1	3,966	6.7	59,214
2005	6,278	10.6	8,884	15.0	3,837	6.5	59,091
2006	6,461	10.7	9,250	15.2	3,936	6.5	60,666
2007	7,066	10.8	10,093	15.4	4,296	6.6	65,609

Source: Birth Registration Dataset. Note: Ethnicity classifications described on page 333.

Distribution of Births by Pacific Ethnic Group

In addition, when the above figures were broken down by Pacific Ethnic Group a number of additional themes emerged (**Table 115**). These included:

1. Samoan babies comprised the largest Pacific group, followed by those identifying as Tongan and Cook Island Māori. Smaller numbers identified as being Niue, Fijian, Tokelauan, or as belonging to Other Pacific groups.
2. The larger Pacific groups (with the exception of Cook Island Māori) also had the highest proportion of babies identifying solely with that Pacific group, although even amongst Samoan and Tongan babies approximately half also identified with other ethnic groups.
3. Amongst the larger Pacific groups, the proportion identified solely as belonging to one ethnic group declined as the period progressed, either suggesting increasing ethnic heterogeneity, or an increased tendency for parents to report multiple ethic affiliations on their baby's birth registration forms.

Table 115. Number of Pacific Births by Ethnic Group, New Zealand 1996-2007

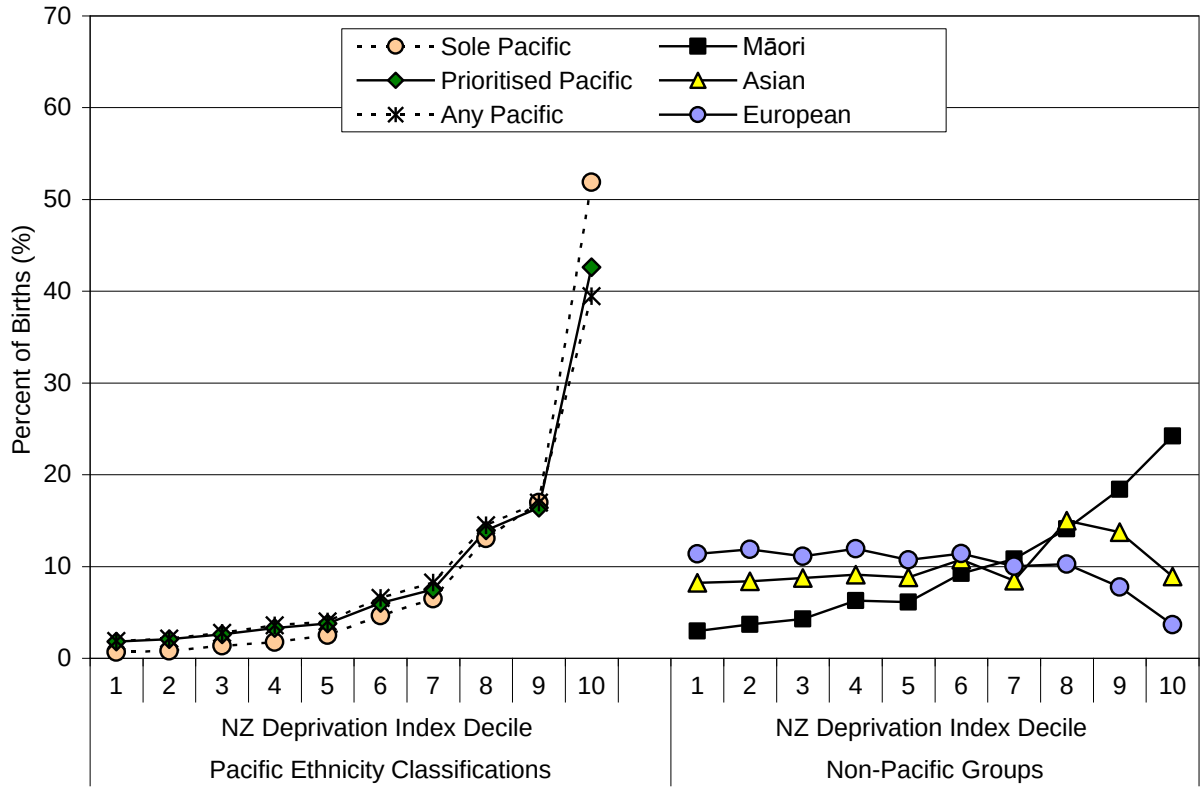
Year	Samoan			Tongan			Cook Island Māori		
	Any	Sole	% Sole	Any	Sole	% Sole	Any	Sole	% Sole
1996	3,905	2,075	53.1	1,548	935	60.4	1,826	583	31.9
1997	3,905	1,992	51.0	1,568	957	61.0	1,869	547	29.3
1998	3,573	1,726	48.3	1,555	923	59.4	1,659	484	29.2
1999	4,303	2,101	48.8	1,830	1,093	59.7	1,873	619	33.0
2000	4,215	2,034	48.3	1,878	1,123	59.8	1,914	554	28.9
2001	4,255	1,978	46.5	1,923	1,065	55.4	1,896	550	29.0
2002	4,175	1,919	46.0	1,834	1,035	56.4	1,875	546	29.1
2003	4,218	1,885	44.7	1,877	1,022	54.4	2,008	573	28.5
2004	4,547	2,038	44.8	1,991	1,011	50.8	2,116	552	26.1
2005	4,463	1,926	43.2	2,024	975	48.2	2,105	564	26.8
2006	4,683	2,019	43.1	2,020	998	49.4	2,185	575	26.3
2007	5,184	2,240	43.2	2,235	1,087	48.6	2,401	614	25.6

Year	Niuean			Fijian			Tokelauan		
	Any	Sole	% Sole	Any	Sole	% Sole	Any	Sole	% Sole
1996	673	147	21.8	234	39	16.7	211	56	26.5
1997	585	133	22.7	224	32	14.3	229	53	23.1
1998	562	114	20.3	199	38	19.1	194	57	29.4
1999	682	131	19.2	206	47	22.8	236	61	25.8
2000	670	133	19.9	220	50	22.7	217	68	31.3
2001	679	107	15.8	226	46	20.4	222	54	24.3
2002	673	104	15.5	263	38	14.4	181	52	28.7
2003	754	105	13.9	283	43	15.2	206	45	21.8
2004	763	108	14.2	281	45	16.0	207	57	27.5
2005	807	128	15.9	272	57	21.0	251	71	28.3
2006	798	125	15.7	294	52	17.7	239	42	17.6
2007	859	87	10.1	330	75	22.7	247	55	22.3

Year	Other Pacific			Total Pacific		
	Any	Sole	% Sole	Any	Sole	% Sole
1996	212	60	28.3	7,670	3,896	50.8
1997	211	78	37.0	7,695	3,795	49.3
1998	183	66	36.1	7,068	3,410	48.2
1999	224	109	48.7	8,363	4,162	49.8
2000	217	82	37.8	8,369	4,046	48.3
2001	272	123	45.2	8,393	3,924	46.8
2002	287	148	51.6	8,231	3,845	46.7
2003	291	169	58.1	8,470	3,844	45.4
2004	286	151	52.8	8,925	3,966	44.4
2005	269	114	42.4	8,884	3,837	43.2
2006	296	122	41.2	9,250	3,936	42.6
2007	333	136	40.8	10,093	4,296	42.6

Source: Birth Registration Dataset. Note: Ethnicity is the ethnicity of the baby as recorded on their birth registration form. Due to a large number of babies who identify with more than one ethnic group, a single baby may be counted more than once across the “Any” categories (see page 333 for details). The % Sole category refers to the proportion of babies in a particular group who identify solely with that ethnic group

Figure 150. Distribution of Births by Ethnicity and NZ Deprivation Index Decile, New Zealand 2003-2007



Source: Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised with the exception of Any / Sole Classification (see page 333 for details).

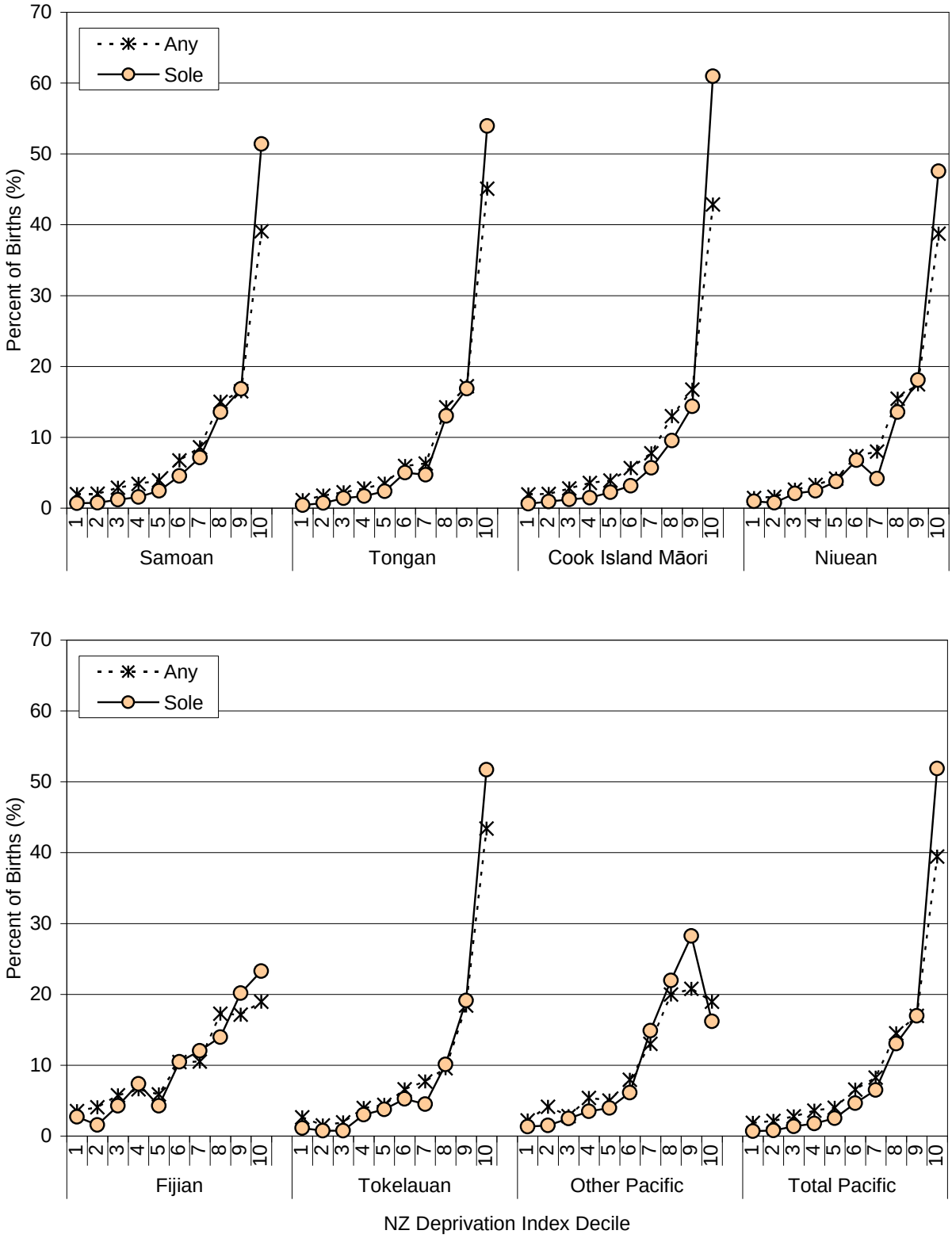
Distribution of Pacific Births by NZ Deprivation Index Decile

Birth registration data for this period also suggested that the distribution of Pacific births by NZ Deprivation Index decile also varied depending on the ethnicity classification used, with 51.9% of Sole Pacific babies being born into the most deprived (NZDep Decile 10) areas, as compared to 39.4% if the Any Pacific classification was used. Irrespective of the classification system however, Pacific babies as a group were much more likely to be born into the most deprived NZDep areas than any other ethnic group (**Figure 150**), with a similar profile being exhibited by all Pacific groups, with the exception of Fijian's and those in the "Other" Pacific group (**Figure 151**).

Distribution of Births by Region

During 2003-2007, 66.5% of New Zealand's Any Pacific births occurred within the three DHBs in the Wider Auckland region. While the pattern was similar for all of New Zealand's larger Pacific Island Groups (67.3% of Any Samoan and 79.0% of Any Tongan births occurred in the Wider Auckland Region), 48.7% of Any Tokelauan births occurred in the two DHBs in the Wellington region. Yet, despite the over representation of Pacific births in the Wider Auckland region, only 27.8% of all births in the Auckland Region during this period were identified as being Any Pacific (**Table 116**, **Table 117**).

Figure 151. Proportion of Pacific Births by NZ Deprivation Index Decile Using Two Different Ethnicity Classifications, New Zealand 2003-2007



Source: Birth Registration Dataset; Note: Ethnicity assigned using Any / Sole Classification (see page 333 for details).

Table 116. Distribution of Pacific Births by Any Ethnic Group and District Health Board, New Zealand 2003-2007 (1 of 2)

DHB	Any Samoan			Any Tongan			Any Cook Island Māori			Any Niuean		
	Number: Total 2003-07	% of DHB Births	% of NZ Samoan Births	Number: Total 2003-07	% of DHB Births	% of NZ Tongan Births	Number: Total 2003-07	% of DHB Births	% of NZ Cook Island Births	Number: Total 2003-07	% of DHB Births	% of NZ Niuean Births
Northland	207	1.9	0.9	153	1.4	1.5	241	2.2	2.2	85	0.8	2.1
Waitemata	3,354	9.2	14.5	1,157	3.2	11.4	1,064	2.9	9.8	623	1.7	15.6
Auckland	3,674	11.6	15.9	2,798	8.8	27.6	1,447	4.6	13.4	941	3.0	23.6
Counties Manukau	8,523	20.7	36.9	4,062	9.9	40.0	4,167	10.1	38.5	1,611	3.9	40.5
Waikato	602	2.3	2.6	305	1.2	3.0	782	3.0	7.2	132	0.5	3.3
Lakes	167	2.0	0.7	84	1.0	0.8	267	3.3	2.5	32	0.4	0.8
Bay of Plenty	249	1.8	1.1	164	1.2	1.6	242	1.7	2.2	43	0.3	1.1
Tairawhiti	74	1.9	0.3	122	3.2	1.2	63	1.6	0.6	11	0.3	0.3
Taranaki	113	1.5	0.5	24	0.3	0.2	63	0.9	0.6	27	0.4	0.7
Hawke's Bay	592	5.3	2.6	78	0.7	0.8	388	3.5	3.6	24	0.2	0.6
Whanganui	92	2.1	0.4	13	0.3	0.1	68	1.6	0.6	10	0.2	0.3
MidCentral	343	3.1	1.5	202	1.8	2.0	189	1.7	1.7	30	0.3	0.8
Hutt	1,146	11.0	5.0	174	1.7	1.7	333	3.2	3.1	86	0.8	2.2
Capital and Coast	2,056	10.6	8.9	183	0.9	1.8	784	4.1	7.2	129	0.7	3.2
Wairarapa	91	3.6	0.4	11	0.4	0.1	31	1.2	0.3	13	0.5	0.3
Nelson Marlborough	137	1.7	0.6	90	1.1	0.9	53	0.7	0.5	13	0.2	0.3
West Coast	15	0.8	0.1	6	0.3	0.1	7	0.4	0.1	2	0.1	0.1
Canterbury	1,093	3.5	4.7	241	0.8	2.4	304	1.0	2.8	86	0.3	2.2
South Canterbury	27	0.9	0.1	25	0.8	0.2	11	0.4	0.1	7	0.2	0.2
Otago	183	1.8	0.8	103	1.0	1.0	136	1.4	1.3	16	0.2	0.4
Southland	148	2.0	0.6	25	0.3	0.2	93	1.3	0.9	16	0.2	0.4
NZ Total	23,095	7.7	100.0	10,147	3.4	100.0	10,815	3.6	100.0	3,981	1.3	100.0

Source: Birth Registration Dataset; Ethnicity is that of the baby as recorded on their birth registration form. Any category includes births where the specified Pacific group was recorded in Any of the first three ethnic groups. Due to a large number of babies who identify with more than one ethnic group, a single baby may be counted more than once across these ethnic groups.

Table 117. Distribution of Pacific Births by Any Ethnic Group and District Health Board, New Zealand 2003-2007 (2 of 2)

DHB	Any Fijian			Any Tokelauan			Any Other Pacific			Any Total Pacific		
	Number: Total 2003-07	% of DHB Births	% of NZ Fijian Births	Number: Total 2003-07	% of DHB Births	% of NZ Tokelauan Births	Number: Total 2003-07	% of DHB Births	% of NZ Other Pacific Births	Number: Total 2003-07	% of DHB Births	% of NZ Pacific Births
Northland	47	0.4	3.2	13	0.1	1.1	29	0.3	2.0	729	6.6	1.6
Waitemata	271	0.7	18.6	112	0.3	9.7	503	1.4	34.1	6,129	16.9	13.4
Auckland	281	0.9	19.2	53	0.2	4.6	155	0.5	10.5	7,951	25.0	17.4
Counties Manukau	323	0.8	22.1	163	0.4	14.2	184	0.4	12.5	16,297	39.6	35.7
Waikato	97	0.4	6.6	11	0.0	1.0	94	0.4	6.4	1,873	7.3	4.1
Lakes	23	0.3	1.6	103	1.3	9.0	26	0.3	1.8	655	8.0	1.4
Bay of Plenty	41	0.3	2.8	15	0.1	1.3	32	0.2	2.2	746	5.3	1.6
Tairawhiti	5	0.1	0.3	3	0.1	0.3	11	0.3	0.7	280	7.2	0.6
Taranaki	7	0.1	0.5	4	0.1	0.3	19	0.3	1.3	246	3.4	0.5
Hawke's Bay	25	0.2	1.7	21	0.2	1.8	24	0.2	1.6	1,086	9.8	2.4
Whanganui	23	0.5	1.6	6	0.1	0.5	5	0.1	0.3	207	4.8	0.5
MidCentral	26	0.2	1.8	29	0.3	2.5	34	0.3	2.3	795	7.2	1.7
Hutt	47	0.5	3.2	181	1.7	15.7	23	0.2	1.6	1,772	17.0	3.9
Capital and Coast	74	0.4	5.1	379	2.0	33.0	110	0.6	7.5	3,211	16.6	7.0
Wairarapa	10	0.4	0.7	6	0.2	0.5	4	0.2	0.3	155	6.2	0.3
Nelson Marlborough	26	0.3	1.8	5	0.1	0.4	22	0.3	1.5	321	4.0	0.7
West Coast	1	0.1	0.1	0	0.0	0.0	5	0.3	0.3	36	1.9	0.1
Canterbury	68	0.2	4.7	19	0.1	1.7	54	0.2	3.7	1,760	5.7	3.9
South Canterbury	0	0.0	0.0	1	0.0	0.1	7	0.2	0.5	73	2.4	0.2
Otago	28	0.3	1.9	16	0.2	1.4	11	0.1	0.7	445	4.4	1.0
Southland	7	0.1	0.5	1	0.0	0.1	11	0.1	0.7	284	3.8	0.6
NZ Total	1,460	0.5	100.0	1,150	0.4	100.0	1,475	0.5	100.0	45,622	15.2	100.0

Source: Birth Registration Dataset; Ethnicity is that of the baby as recorded on their birth registration form. Any category includes births where the specified Pacific group was recorded in Any of the first three ethnic groups. Due to a large number of babies who identify with more than one ethnic group, a single baby may be counted more than once across these ethnic groups.

Census Data

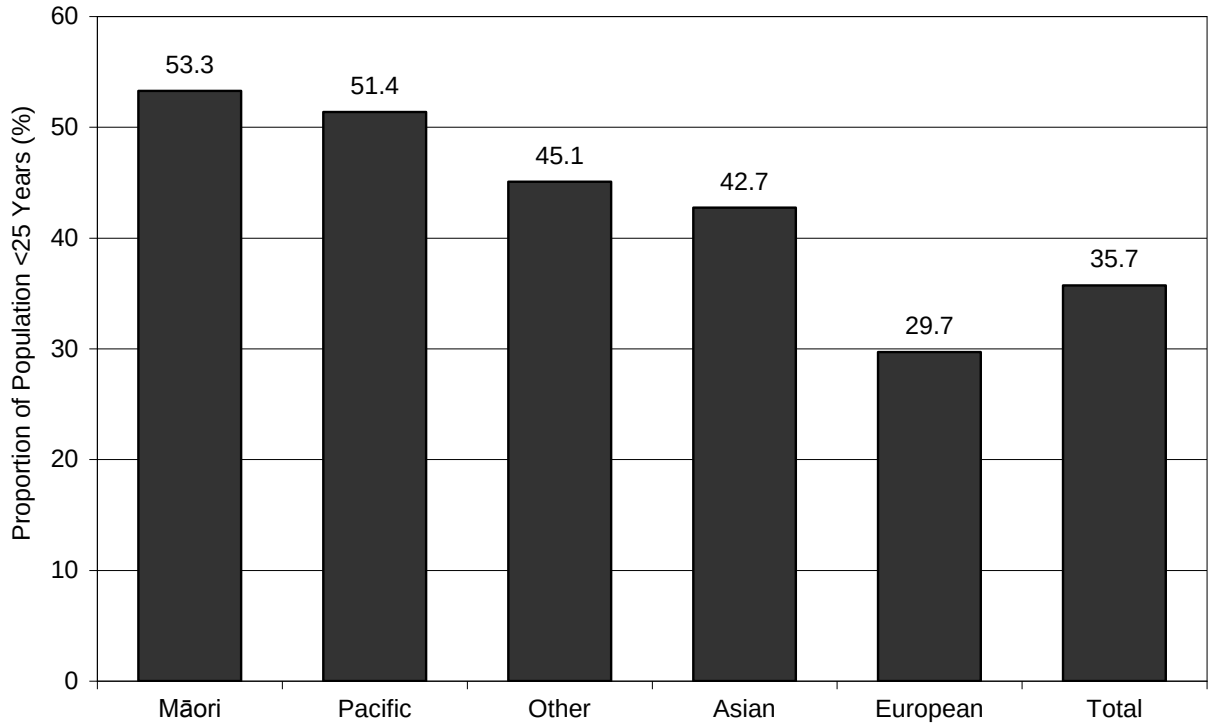
Census data also provides some useful insights into the demographic profile of New Zealand's Pacific children and young people. During 2006 (using prioritised ethnicity), 8.7% of children (0-14 years) and 7.1% of young people (15-24 years) were identified as belonging to a Pacific ethnic group (**Table 118**).

Table 118. Distribution of Children and Young People 0-24 Years by Ethnicity, New Zealand at the 2006 Census

Ethnic Group	Number	%
Children 0-14 Years		
European	479,418	55.3
Māori	199,914	23.0
Pacific	75,528	8.7
Asian	70,479	8.1
Other	8,652	1.0
Not Stated	33,555	3.9
Total	867,573	100.0
Young People 15-24 Years		
European	320,736	56.2
Māori	101,298	17.7
Pacific	40,707	7.1
Asian	75,180	13.2
Other	6,630	1.2
Not Stated	26,619	4.7
Total	571,182	100.0

Source: Statistics New Zealand. Note: Ethnicity is Level 1 Prioritised.

Figure 152. Proportion of the New Zealand Population Who Were Under 25 Years of Age by Ethnicity at the 2006 Census



Source: Statistics New Zealand. Note: Ethnicity is Level 1 Prioritised.

In 2006, 51.4% of the Pacific population (Level 1 Prioritised) were under the age of 25 years, as compared to 29.7% of the European population and 35.7% for the population as a whole (**Figure 152**). Only the Māori population (53.3%) had a higher proportion of children and young people than the Pacific population at the 2006 Census.

Distribution of Children and Young People by Pacific Ethnic Group

In comparing the results of the 1996, 2001 and 2006 Censuses with birth registration data a number of other themes also emerged including (**Table 114**, **Table 115**, **Table 119**):

1. A comparison of 2006 birth registration and Census data potentially suggests that a lower proportion of Pacific parents report multiple ethnic affiliations on their children's Census forms, than do on their baby's birth registration forms.
2. While birth registration data suggest that either the Pacific population in New Zealand is becoming more heterogeneous, (or that more parents are choosing to report multiple ethnic affiliations on their baby's birth registration forms), a comparable analysis of Census data is not possible due to differences in the way in which ethnicity information was collected at each of the last 3 Censuses.
3. Within each of the last three Censuses however, young people have been more likely to report a sole ethnic identity than have the parents of Pacific children. It remains uncertain however whether this reflects the increasing diversity of Pacific children in New Zealand in recent years, a tendency for Parents to fill our their children's Census forms in a different manner to the way in which the child chooses to do so once they reach adolescence, or a tendency for young people as they get older to more closely identify with a single ethnic group.

Distribution of Children and Young People by Region

As with the analysis of births, 66.1% of Pacific children and young people (0-24 years) in New Zealand lived in the Wider Auckland Region, although within this Region only 19.9% of children and young people were of Pacific Island origin (**Table 120, Table 121**).

Summary

The Pacific population in New Zealand is becoming increasingly ethnically diverse, with large numbers of Pacific children and young people simultaneously identifying with other ethnic groups. As a consequence, the way in which ethnicity is coded in New Zealand's national datasets is likely to play an important role in defining how health outcomes for Pacific children and young people are portrayed. Despite these differences, the majority of Pacific children and young people in New Zealand share a very similar demographic profile, with higher proportions living in the Wider Auckland region, and in areas characterised by relative socioeconomic deprivation. The relative youth of the New Zealand Pacific population also suggests that the issues facing Pacific children and young people may potentially have a much greater impact on the Pacific population as a whole, than occurs for other ethnic groups. Each of these factors must to be taken into account when interpreting the information presented in the sections which follow.

Table 119. Number of Pacific Children and Young People 0-24 Years by Ethnic Group at the 1996, 2001 and 2006 Censuses

Children 0-14 Years									
Ethnic Group	1996			2001			2006		
	Any	Sole	% Sole	Any	Sole	% Sole	Any	Sole	% Sole
Samoan	39,903	20,409	51.1	44,958	24,108	53.6	49,962	25,383	50.8
Cook Island Māori	19,905	7,005	35.2	22,170	8,757	39.5	23,751	8,316	35.0
Tongan	13,356	7,353	55.1	17,379	10,506	60.5	21,315	12,411	58.2
Niue	7,533	2,043	27.1	8,184	2,034	24.9	8,922	1,704	19.1
Tokelauan	2,001	732	36.6	2,637	843	32.0	2,865	711	24.8
Fijian	2,424	468	19.3	2,340	630	26.9	3,168	1,014	32.0
Other Pacific	1,635	363	22.2	2,409	936	38.9	3,105	1,365	44.0
Pacific NOS	90	27	30.0	135	39	28.9	159	81	50.9
Total Pacific	79,248	38,397	48.5	90,147	47,859	53.1	100,344	50,862	50.7
Young People 15-24 Years									
Ethnic Group	1996			2001			2006		
	Any	Sole	% Sole	Any	Sole	% Sole	Any	Sole	% Sole
Samoan	19,689	11,754	59.7	20,481	13,479	65.8	23,697	14,976	63.2
Cook Island Māori	8,652	4,254	49.2	9,387	5,121	54.6	11,043	5,469	49.5
Tongan	5,262	2,676	50.9	6,942	4,440	64.0	8,616	5,847	67.9
Niue	3,456	1,368	39.6	3,669	1,443	39.3	4,338	1,449	33.4
Tokelauan	1,077	489	45.4	1,137	501	44.1	1,269	534	42.1
Fijian	1,623	435	26.8	1,341	489	36.5	1,890	828	43.8
Other Pacific	1,239	504	40.7	1,386	699	50.4	1,503	747	49.7
Pacific NOS	51	21	41.2	90	39	43.3	114	69	60.5
Total Pacific	38,040	21,498	56.5	41,265	26,214	63.5	48,411	29,844	61.6

Source: Statistics New Zealand; Ethnicity assigned using Any / Sole Classification (see page 333 for details); Slight differences in the way in which information on ethnicity was sought between the 1996, 2001 and 2006 Censuses mean that the percentage of children and young people who identify solely with one ethnic group may not be strictly comparable between Censuses.

Table 120. Distribution of Any Pacific Children and Young People 0-24 Years by Ethnicity and DHB, New Zealand at the 2006 Census (1 of 2)

DHB	Any Samoan			Any Cook Island Māori			Any Tongan			Any Niuean			DHB Total (All Ethnic Groups)
	Number	% of DHB	% of NZ Samoan	Number	% of DHB	% of NZ Cook Island	Number	% of DHB	% of NZ Tongan	Number	% of DHB	% of NZ Niuean	
Northland	747	1.4	1.0	831	1.6	2.4	453	0.9	1.5	279	0.5	2.1	51,936
Waitemata	10,323	6.0	14.0	3,186	1.8	9.2	3,417	2.0	11.4	1,983	1.2	15.0	172,260
Auckland	11,601	8.1	15.7	4,683	3.3	13.5	8,352	5.8	27.9	3,291	2.3	24.8	143,343
Counties Manukau	27,204	15.3	36.9	12,777	7.2	36.7	11,859	6.7	39.6	5,079	2.9	38.3	177,228
Waikato	2,088	1.7	2.8	2,547	2.0	7.3	1,023	0.8	3.4	534	0.4	4.0	126,285
Lakes	552	1.5	0.7	906	2.5	2.6	273	0.8	0.9	108	0.3	0.8	36,321
Bay of Plenty	762	1.2	1.0	756	1.1	2.2	441	0.7	1.5	180	0.3	1.4	66,222
Tairawhiti	231	1.3	0.3	231	1.3	0.7	249	1.4	0.8	39	0.2	0.3	17,403
Taranaki	360	1.0	0.5	210	0.6	0.6	96	0.3	0.3	93	0.3	0.7	35,793
Hawke's Bay	1,473	2.8	2.0	1,284	2.5	3.7	282	0.5	0.9	84	0.2	0.6	52,305
Whanganui	312	1.4	0.4	282	1.3	0.8	69	0.3	0.2	39	0.2	0.3	21,645
MidCentral	1,137	2.0	1.5	735	1.3	2.1	612	1.1	2.0	177	0.3	1.3	58,017
Hutt	4,059	8.2	5.5	1,134	2.3	3.3	657	1.3	2.2	270	0.5	2.0	49,326
Capital and Coast	7,263	7.7	9.9	2,778	2.9	8.0	606	0.6	2.0	489	0.5	3.7	94,275
Wairarapa	237	1.9	0.3	135	1.1	0.4	42	0.3	0.1	42	0.3	0.3	12,372
Nelson Marlborough	372	0.9	0.5	249	0.6	0.7	258	0.6	0.9	69	0.2	0.5	40,461
West Coast	60	0.6	0.1	33	0.3	0.1	36	0.4	0.1	6	0.1	0.0	9,789
Canterbury	3,621	2.3	4.9	1,128	0.7	3.2	711	0.4	2.4	336	0.2	2.5	158,202
South Canterbury	114	0.7	0.2	48	0.3	0.1	66	0.4	0.2	12	0.1	0.1	16,308
Otago	735	1.2	1.0	534	0.8	1.5	339	0.5	1.1	90	0.1	0.7	63,642
Southland	411	1.2	0.6	330	0.9	0.9	99	0.3	0.3	63	0.2	0.5	35,553
NZ Total	73,659	5.1	100.0	34,794	2.4	100.0	29,934	2.1	100.0	13,260	0.9	100.0	1,438,749

Source: Statistics New Zealand; Includes children and young people who identify as Pacific in ANY of their three first ethnic groups; Due to the large number who identify with more than one ethnic group, a single individual may be counted more than once across any of these ethnic groups.

Table 121. Distribution of Any Pacific Children and Young People 0-24 Years by Ethnicity and DHB, New Zealand at the 2006 Census (2 of 2)

DHB	Any Tokelauan			Any Fijian			Any Other Pacific Peoples			Total Pacific			DHB Total (All Ethnic Groups)
	Number	% of DHB	% of NZ Tokelauan	Number	% of DHB	% of NZ Fijian	Number	% of DHB	% of NZ Other Pacific	Number	% of DHB	% of NZ Pacific	
Northland	30	0.1	0.7	171	0.3	3.4	90	0.2	2.0	2,418	4.7	1.6	51,936
Waitemata	342	0.2	8.3	987	0.6	19.5	1,407	0.8	30.5	19,329	11.2	13.0	172,260
Auckland	219	0.2	5.3	930	0.6	18.4	543	0.4	11.8	26,151	18.2	17.6	143,343
Counties Manukau	561	0.3	13.6	996	0.6	19.7	771	0.4	16.7	52,788	29.8	35.5	177,228
Waikato	72	0.1	1.7	345	0.3	6.8	396	0.3	8.6	6,459	5.1	4.3	126,285
Lakes	408	1.1	9.9	129	0.4	2.6	69	0.2	1.5	2,241	6.2	1.5	36,321
Bay of Plenty	63	0.1	1.5	90	0.1	1.8	129	0.2	2.8	2,286	3.5	1.5	66,222
Tairawhiti	15	0.1	0.4	30	0.2	0.6	24	0.1	0.5	792	4.6	0.5	17,403
Taranaki	21	0.1	0.5	48	0.1	0.9	60	0.2	1.3	846	2.4	0.6	35,793
Hawke's Bay	60	0.1	1.5	57	0.1	1.1	54	0.1	1.2	3,126	6.0	2.1	52,305
Whanganui	24	0.1	0.6	90	0.4	1.8	21	0.1	0.5	804	3.7	0.5	21,645
MidCentral	96	0.2	2.3	171	0.3	3.4	114	0.2	2.5	2,859	4.9	1.9	58,017
Hutt	627	1.3	15.2	159	0.3	3.1	105	0.2	2.3	6,417	13.0	4.3	49,326
Capital and Coast	1,398	1.5	33.8	315	0.3	6.2	405	0.4	8.8	11,646	12.4	7.8	94,275
Wairarapa	21	0.2	0.5	30	0.2	0.6	27	0.2	0.6	498	4.0	0.3	12,372
Nelson Marlborough	21	0.1	0.5	78	0.2	1.5	54	0.1	1.2	1,008	2.5	0.7	40,461
West Coast	<5	s	s	21	0.2	0.4	9	0.1	0.2	156	1.6	0.1	9,789
Canterbury	66	0.0	1.6	276	0.2	5.5	192	0.1	4.2	5,973	3.8	4.0	158,202
South Canterbury	9	0.1	0.2	6	0.0	0.1	15	0.1	0.3	255	1.6	0.2	16,308
Otago	57	0.1	1.4	90	0.1	1.8	87	0.1	1.9	1,806	2.8	1.2	63,642
Southland	18	0.1	0.4	33	0.1	0.7	27	0.1	0.6	897	2.5	0.6	35,553
NZ Total	4,134	0.3	100.0	5,058	0.4	100.0	4,608	0.3	100.0	148,755	10.3	100.0	1,438,749

Source: Statistics New Zealand. Note: Includes children and young people who identify as Pacific in ANY of their three first ethnic groups; Due to the large number who identify with more than one ethnic group, a single individual may be counted more than once across any of these ethnic groups; s: small numbers preclude rate calculation.

APPENDICES

Appendix 1 : Statistical Significance Testing and Its Use in This Report

Understanding Statistical Significance Testing

Inferential statistics are used when a researcher wishes to use a sample to draw conclusions about the population as a whole (e.g. weighing a class of 10 year old boys, in order to estimate the average weight of all 10 year old boys in New Zealand). Any measurements based on a sample however, even if drawn at random, will always differ from that of the population as a whole, simply because of chance. Similarly, when a researcher wishes to determine whether the risk of a particular condition (e.g. lung cancer) is truly different between two groups (smokers and non-smokers), they must also consider the possibility that the differences observed arose from chance variations in the populations sampled.

Over time, statisticians have developed a range of measures to quantify the uncertainty associated with random sampling error (i.e. to quantify the level of confidence we can have that the average weight of boys in our sample reflects the true weight of all 10 year old boys, or that the rates of lung cancer in smokers are really different to those in non-smokers). Of these measures, two of the most frequently used are:

1. **P values**: The p value from a statistical test tells us the probability that we would have seen a difference at least as large as the one observed, if there were no real differences between the groups studied (e.g. if statistical testing of the difference in lung cancer rates between smokers and non-smokers resulted in a p value of 0.01, this tells us that the probability of such a difference occurring if the two groups were identical is 0.01 or 1%. Traditionally, results are considered to be statistically significant (i.e. unlikely to be due to chance) if the probability is <0.05 (i.e. less than 5%) [287].
2. **Confidence Intervals:** A 95% Confidence Interval suggests that if you were to repeat the sampling process 100 times, 95 times out of 100 the confidence interval would include the true value. In general terms, if the 95% confidence intervals of two samples overlap, there is no significant difference between them (i.e. the p value would be ≥0.05), whereas if they do not overlap, they can be assumed to be statistically different at the 95% confidence level (i.e. the p value would be <0.05) [287].

The Use of Statistical Significance Testing in this Report

In the preparation of this report a large range of data sources were used. For the purposes of statistical significance testing however, these data sources can be considered as belonging of one of two groups: Population Surveys and Routine Administrative Datasets. The relevance of statistical testing to each of these data sources is described separately below:

1. **Population Surveys**: A number of indicators in this reporting series utilise data derived from national surveys (e.g. Action for Smoking and Health (ASH) Smoking Surveys, the NZ Children's Nutrition Survey), where information from a sample has been used to make inferences about the population as a whole. In this context statistical significance testing is appropriate, and where such information is available in published reports, it has been incorporated into the text accompanying each graph or table (i.e. the words *significant*, or *not significant* in italics are used to imply that a test of statistical significance has been applied to the data and that the significance of the associations are as indicated). In a small number of cases however (e.g. SPARC Physical Activity Surveys) information on statistical significance was not available in published reports, and in such cases any associations described do not imply statistical significance.
2. **Numbers and Rates Derived from Routine Administrative Data**: A large number of the indicators in this report are based on data derived from New Zealand's administrative data sets (e.g. Birth Registration, Hospital Admission, Mortality), which capture information on all of the events occurring in a particular category. Such datasets can thus be viewed as

providing information on the entire population, rather than a sample and as a consequence, 95% confidence intervals are not required to quantify the precision of the estimate (e.g. the number of leukaemia deaths in 2000-2004, although small is not an estimate, but rather reflects the total number of deaths during this period). As a consequence, 95% confidence intervals have not been provided for any of the descriptive data (numbers, proportions, rates) presented in this report, on the basis that the numbers presented are derived from the total population under study.

3. **Rate Ratios Derived from Routine Administrative Data**: In considering whether statistical significance testing is ever required when using total population data Rothman [288] notes that if one wishes only to consider descriptive information (e.g. rates) relating to the population in question (e.g. New Zealand), then statistical significance testing is probably not required (as per the argument above). If however, one wishes to use total population data to explore biological phenomena more generally, then the same population can also be considered to be a sample of a larger super-population, for which statistical significance testing may be required (e.g. the fact that SIDS in New Zealand is 10 times higher in the most deprived NZDep areas might be used to make inferences about the impact of the socioeconomic environment on SIDS mortality more generally (i.e. outside of New Zealand, or the 5 year period concerned)). Similarly, in the local context the strength of observed associations is likely to vary with the time period under study (e.g. in updating 5-year asthma admission data from 2002-2006 to 2003-2007, rate ratios for Pacific children are likely to change due to random fluctuations in annual rates, even though the data utilised includes all admissions recorded for that particular 5-year period). Thus in this report, whenever measures of association (i.e. rate ratios) are presented, 95% confidence intervals have been provided on the assumption that the reader may wish to use such measures to infer wider relationships between the variables under study [288].

The Signalling of Statistical Significance in this Report

In order to assist the reader to identify whether tests of statistical significance have been applied in a particular section, the *Data Sources and Methods* text box accompanying each indicator includes a small paragraph entitled *Statistical Significance Testing* (see examples below*)*. It is suggested the reader briefly reviews this information before considering the analyses presented in the sections which follow.

Data Sources and Methods

Statistical Significance Testing Example 1

Note: Tests of statistical significance have not been applied to any of the data in this section, and thus any associations described do not imply statistical significance or non-significance.

Statistical Significance Testing Example 2

Note: Tests of statistical significance (in the form of 95% confidence intervals) have been applied to some of the data in this section. Where relevant, the significance of these associations has been signalled in the text (with the words *significant*, or *not significant* in italics being used to denote the statistical significance of the observed association). Where the words *significant* or *non-significant* do not appear in the text, then the associations described do not imply statistical significance or non-significance.

Appendix 2: Search Methodology for Policy Documents & Evidence Based Reviews

One of the new features of this reporting series are sections which briefly review local policy documents (e.g. Ministry of Health Strategies / Toolkits) and international evidence based reviews relevant to the prevention / management of child and youth health issues. The approaches taken in these sections borrow heavily from the principles of the Evidence Based Medicine (EBM) movement, which has emerged in recent years as a means of providing busy clinicians with up to date overviews of the evidence in particular areas [289]. Such overviews generally rely on reviewers collating all of the available evidence (e.g. published and unpublished trials and observational studies), evaluating this in a rigorous manner, and then publishing the resulting synthesis in a format which allows clinicians to quickly evaluate the effectiveness of the intervention(s) reviewed. While the evidence base for population level interventions is much less developed than for individual patient therapies (as such interventions often have longer follow up times, more diffuse outcomes, and less readily identifiable "control" groups [290]), there is nevertheless a reasonable body of evidence emerging as to the effectiveness of population level interventions in particular areas.

The brief overviews presented in this report, thus aim to provide busy DHB staff with a logical starting point for considering the types of intervention available to address particular child and youth health issues. In preparing these overviews however, the methodology used was not exhaustive, but rather involved searching a restricted number of EBM journals and databases (e.g. the Cochrane Library) for systematic reviews of population level interventions in child and youth health (see Text Box below).

Methodology Used in Preparing Policy / Evidence Based Review Sections

New Zealand (Health) Policy Documents

Each section aimed to provide an overview of Ministry of Health (or where appropriate, other Government Agency) policy documents and strategies relevant to the area. The Ministry of Health's website **(http://www.MOH.govt.nz)** was searched for key documents. All identified documents were then scanned and the most relevant summarised, with the focus being on those which provided strategic guidance to DHBs on the prevention / population level management of the issues in question.

Evidence Based and Other Reviews

The five databases listed below were searched for reviews which considered the effectiveness of population level interventions to prevent / manage each of the issues in question. While this list is not exhaustive, the databases were selected on the basis of the calibre of the institutions publishing the reviews. In addition, the search strategy concentrated on publications which attempted to synthesise all of the available evidence, thereby providing as broad as possible coverage of the relevant literature. In general, only literature from 2000 onwards was searched, although earlier publications were included if there was a paucity of more recent information. While individual trials and protocols were not specifically sought, if there was no other relevant information available, an attempt was made to locate individual research reports or recommendations. While not being exhaustive, it is nevertheless hoped that these brief overviews will provide a useful starting point for DHBs wishing to explore strategies to address particular child and youth health issues.

Evidence Based Medicine Reviews-Full Text: This allows three databases to be searched simultaneously: 1) The ACP Journal Club comprising two journals; ACP Journal Club and Evidence-Based Medicine 2) The Cochrane Database of Systematic Reviews; and 3) The Database of Reviews of Effects (DARE) produced by National Health Services' Centre for Reviews and Dissemination at the University of York, UK.

The Health Care Needs Assessment Series: This is funded by the department of Health/National Institute of Clinical Excellence and is complied and managed in the Department of Public Health and Epidemiology at the University of Birmingham (http://hcna.radcliffe-oxford.com)

Centre for Reviews and Dissemination (CRD): This is a Department of the University of York and is part of the National Centre for Health Research (NCHR) (http://www.york.ac.uk/inst/crd/). While CRD produces the database of Review Effects (DARE), captured in the Evidence Based Medicine Review Database, searching the CRD site identifies other reviews not captured by DARE. This database is available through most local library services.

National Institute for Health and Clinical Excellence (NICE): This is an independent organisation based in the United Kingdom which provides national guidance on promotion of good health, prevention and treatment of ill health. (http://www.nice.org.uk)

Guide to Community Preventive Services: Systematic Reviews and Evidence Based Recommendations: This guide was developed by the non-federal Task Force on Community Preventive Services whose members are appointed by the Director of the Centre for Disease Control and Prevention (CDC)(http://www.thecommunityguide.org/about/). The Community Guide summarises what is known about the effectiveness, economic efficiency, and feasibility of interventions to promote community health and prevent disease.

While undertaking this task, it quickly became apparent that the quality of evidence varied considerably depending on the issue reviewed (e.g. while a considerable literature exists as to the most effective ways to improve immunisation coverage, there is a paucity of evidence based solutions for the prevention of gastro-oesophageal reflux or constipation). In addition, in many cases the research provided reasonably strong guidance as what did not work (e.g. current evidence suggests additional social support is ineffective in preventing preterm birth in high-risk women), but little advice as to effective interventions.

Thus in many cases, these brief overviews served to highlight the current paucity of evidence on population level interventions to address child and youth health need (although the absence of systematic / other reviews, does not rule out the existence of individual studies in particular areas). In this context, while the search strategy utilised did not primarily aim to identify individual studies, or reviews of individual patient therapies, in cases where such studies were identified, and where no other systematic reviews were available, they were included under the heading of *Other Relevant Publications*. In such cases however, the reader needs to be reminded that these studies were identified in a non-systematic manner and that their findings should thus not be given the same weight as systematic reviews (e.g. Cochrane reviews) where all the available evidence has been evaluated using a rigorous methodology.

Appendix 3: Data Quality Grading System for Indicators in this Report

One of the central aims of the Child and Youth Health Indicator project was to develop an overall map of all of the issues which needed to be taken into account when planning child and youth health services and strategies at a population level. Yet very early on in the course of consultation it became apparent that adequate data sources were available for only a fraction of the issues that those working in the health sector considered important to child and youth health. In order to ensure that issues for which adequate data was available did not take undue precedence over those for which reliable data was lacking, it was decided early on that a set of indicator selection criteria would be developed, which awarded a high priority to public health importance. Where an issue was deemed to have met these criteria but where routine data sources were lacking, "non-traditional" data sources would then be considered, in order to ensure that the issue did not fall below the public health radar.

Such an approach however, meant that many of the indicators included in the Indicator Framework may not have met the stricter data quality criteria utilised by other Government agencies. In order to highlight the impacts that such data quality issues may have had on the interpretability of the data, it was felt necessary to grade each indicator on the degree to which it captured the issue it was designed to measure, as well as the quality of its data source. Thus each indicator in the framework was assigned to one of three categories: Ideal, Proxy or Bookmark, and an assessment made as to whether its data sources were Excellent (A), Adequate (B), or whether Further Work (C) was required in order to improve the interpretability of the indicator (**Table 122)**. These categories are outlined below:

1. **Ideal Indicators**: An indicator was considered ideal if it offered the potential to measure the total extent of a particular issue e.g. because the birth registration dataset captures >99% of births in New Zealand and information on gestational age is >98% complete, the preterm birth indicator derived from this dataset was considered ideal, in that it allowed conclusions to be drawn about trends in the incidence of preterm birth over time.
2. **Proxy Indicators**: In many cases, while it was not possible to measure the full extent of an issue, it was possible to assess the number of children and young people attending publicly funded services for its management e.g. while hospital admission data is unable to provide any commentary on the total number of injuries occurring in the community (as many injuries are treated in primary care, or at home), such data is nevertheless useful for assessing the workload such injuries create for secondary and tertiary services. One of the chief limitations of proxy indicators, however, is the variable extent to which they capture the total burden of morbidity (e.g. while nearly all non-fatal cases of meningococcal disease are likely to be captured by hospital admission data, the same datasets are likely to record only a fraction of gastroenteritis cases occurring in the community). While it is generally assumed that if admission thresholds remain constant (i.e. that children with a given level of severity for a condition will be managed in the same way), then such indicators can be used to track trends in the underlying burden of morbidity, in reality such thresholds are very seldom static and vary in ways which are both predictable (e.g. the introduction of pulse oximetry altering admission thresholds for infants with bronchiolitis over time) and unpredictable (e.g. differences in the ways in which DHBs upload their emergency department cases to the National Minimum Dataset). Thus while being of considerable utility in planning for future health service demand, such indicators are less useful for tracking temporal trends in the total burden of morbidity occurring in the community.
3. **Bookmark Indicators**: In many cases, consultation suggested that there was a need for indicators in areas where no data sources existed e.g. indicators to assess the prevalence of disability amongst New Zealand children by diagnostic category (e.g. autism, cerebral palsy) and by degree of functional impairment (e.g. visual acuity, degree of hearing loss).

While more traditional approaches to indicator development might have suggested that such issues should be excluded from the monitoring framework until such time as high quality data sources could be developed, such approaches may also have inadvertently resulted in the needs of children and young people with these conditions slipping below the public health radar, and as a consequence being awarded a lesser priority in resource allocation decisions. Thus it was decided that a number of “Bookmark Indicators” should be created, which served to highlight particular issues until such time as more appropriate data sources could be developed. Where possible, such indicators would use currently available data sources to capture particular facets of the wider issue e.g. the current Mental Health Section contains three indicators – Children Calling Telephone Based Counselling Services, Inpatient Hospital Admissions for Mental Health Issues and Hospital Admissions and Mortality from Self Inflicted Injuries. While it is acknowledged that collectively these indicators fail to capture the full scope of child and youth mental health issues (the majority of which are managed on an outpatient basis and are thus not adequately represented by inpatient hospital admissions), it is nevertheless hoped that these indicators will serve as a “Bookmark” for child and youth mental health issues, until such time as better indicators can be developed.

A more detailed review of each of the data sources used to develop this Framework is included in the series of Appendices which follow. Readers are urged to be aware of the contents of these Appendices when interpreting the information in this report, and in particular the manner in which the inconsistent uploading of Emergency Department cases to the National Minimum Dataset hinders the interpretation of hospital admission trend data.

Table 122. Indicator Categories Based on the Type of the Indicator and the Quality of its Data Source

Indicator Type	Data Quality		
	Excellent (A)	Adequate (B)	Further Work Required (C)
Ideal	Measures total extent of an issue and data quality permits appropriate interpretation of trends and population level differences (No NZ indicators currently in this category)	Measures total extent of an issue and data quality permits adequate interpretation of information once the limitations of the datasets have been outlined E.g. Interpretation of trends in highest attainment at school leaving requires an understanding of changes associated with the roll out of the NCEA which began in 2002. While such changes make interpretation of trends difficult, improvements in data quality per se are unlikely to improve this situation	Measures total extent of an issue but data quality limits appropriate interpretation E.g. While theoretically the MOH's two oral health indicators provide near complete coverage of children at 5 and 12 years of age, in reality information is only collected on those who have completed treatment, potentially discounting the poor oral health status of children still undergoing treatment for dental caries at these points in time
Proxy	Measures attendances at publicly funded services for management of an issue and data quality permits appropriate interpretation of trends and population level differences (No NZ indicators currently in this category)	Measures attendances at publicly funded services for management of an issue and data quality permits adequate interpretation once the limitations of the datasets have been outlined E.g. Hospital admission data, when combined with mortality data, provides a reasonable overview of the incidence of invasive meningococcal disease. While a number of data quality issues apply to all indicators derived from these datasets (e.g. accuracy of coding), such limitations are unlikely to significantly hinder the interpretation of the data in this context	Measures attendances at publicly funded services for management of an issue but data quality currently limits appropriate interpretation E.g. Because of the inconsistent manner in which some DHBs have uploaded their emergency department cases to the hospital admission dataset over time, it is difficult to interpret trends in hospital admissions for minor injuries with any certainty. Thus while cross sectional analyses provide an overview of the types if injuries presenting to secondary and tertiary services, interpretation of trend data is significantly impeded by the quality of the datasets
Bookmark	Measures one facet of a wider issue, or provides a brief overview of the literature in an area where no data sources currently exist. Data quality for isolated facets permits appropriate interpretation. (No NZ indicators currently in this category)	Measures one facet of a wider issue, or provides a brief overview of the literature in an area where no data sources currently exist. Data quality for isolated facets permits adequate interpretation once the limitations of the datasets have been outlined E.g. The 2002 Children's Nutrition Survey provides a reasonable snapshot of overweight and obesity amongst New Zealand children at a single point in time. For this isolated snapshot, data quality permits adequate interpretation of the issues covered by this survey	Measures one facet of a wider issue, or provides a brief overview of the literature in an area where no data sources currently exist. Data quality for isolated facets limits appropriate interpretation E.g. In the absence of routine data on the extent of alcohol related harm amongst New Zealand young people, an analysis of hospital admissions with mention of alcohol in any of the first 15 diagnostic codes provides a snapshot of the types of issues presenting to secondary care services. Significant data quality issues however preclude this data being used to make any inferences about trends in alcohol related harm

Appendix 4: The National Minimum Dataset

Mode of Data Collection

The National Minimum Dataset (NMDS) is New Zealand's national hospital discharge data collection and is maintained by the New Zealand Health Information Service (NZHIS). The information contained in the dataset has been submitted by public hospitals in a pre-agreed electronic format since 1993. Private hospital discharges for publicly funded events (e.g. births, geriatric care) have been submitted since 1997. The original NMDS was implemented in 1993, with public hospital information back loaded to 1988 [291]. Information contained in the NMDS includes principal and additional diagnoses, procedures, external causes of injury, length of stay and sub-specialty code and demographic information such as age, ethnicity and usual area of residence.

Dataset Quality and Changes in Coding Over Time

There are a number of key issues which must be taken into account when interpreting information from the NMDS. Many of these issues arise as a result of regional differences in the way in which data is coded and uploaded to the NMDS. These include

1. Inconsistencies in the way in which different providers upload day cases to the NMDS, and how this has changed over time.
2. The changeover from the ICD-9 to ICD-10 coding system, and irregularities in the way in which diagnoses and procedures are allocated ICD codes.
3. Changes in the way in which ethnicity information has been collected over time and across regions (Demography and Measurement of Ethnicity Section).

The following sections discuss the first two if these issues, while the third is discussed in the Demography and Measurement of Ethnicity Section, which reviews the way in which ethnicity information is collected and coded within the health sector.

1. Inconsistencies in the Uploading of Day-Cases to the NMDS

One of the key issues with time series analysis using hospital discharge data is the variability with which different providers upload day cases to the NMDS. Day cases are defined as cases that are admitted and discharged on the same day, with the "three hour rule" (treatment time >3 hours) traditionally being utilised to define an admission event. In contrast patients who spend at least one (mid)night in hospital are classified as inpatients irrespective of their length of stay [292].

In the past, there have been significant regional variations in the way in which different providers have uploaded their day cases to the NMDS, leading to problems with both time series analysis and regional comparisons. These inconsistencies have included

1. During the mid 1990's, a number of providers began to include A&E events as day cases if the total time in the Emergency Department (including waiting time) exceeded 3 hours, rather than uploading only those whose actual treatment time exceeded 3 hours [292]. NZHIS provided feedback which rectified this anomaly and since January 1995 the correct procedure has been used (these additional cases were coded using medical and surgical sub-specialty codes and are thus difficult to filter out using traditional Emergency sub-specialty filters).
2. Over time, a number of providers have become more efficient at recording the time of first treatment within the Emergency Department (rather than time of attendance) and thus during the late 1990s and early 2000s have become more efficient in identifying emergency department cases which meet the 3-hour treatment rule and are thus

eligible to be uploaded to the NMDS. This has resulted in a large number of additional cases being uploaded to the NMDS, particularly in the upper North Island.

3. In addition, some providers admit cases to their short stay observation units while other providers do not, leading to regional variations in the appearance of day cases in the NMDS [164].

Previous Attempts to Address Inconsistent Uploading at the Analytical Stage

When producing their annual Hospital Throughput reports, the Ministry of Health has adopted the following filter to ensure regional and time series comparability with respect to day patient admissions [164]. In its analyses it excludes all cases where:

1. the admission and discharge date are the same (length of stay = 0)
2. and the patient was discharged alive
3. and the health specialty code on discharge is that of Emergency Medicine (M05, M06, M07, and M08).

While this coding filter succeeds in ensuring a degree of comparability between regions and across time (although it fails to correct the anomalies occurring during the mid 1990s when A&E cases were uploaded using medical sub-specialty codes), the exclusion of emergency day cases from time series analysis has a number of limitations including:

1. Exclusion of only those with a length of stay of 0 days means that those emergency cases who begin their treatment late at night and are discharged in the early hours of the following morning (up ¼ of emergency cases have a length of stay of 1 day in some DHBs) are included as genuine hospital admissions, whereas those who begin their treatment early in the morning and are discharged late in the afternoon or the evening of the same day are excluded.
2. With a move towards the development of specialist paediatric emergency departments in larger urban centres (e.g. Auckland), there remains the possibility that some larger DHBs are now seeing and treating a number of acute medical patients within the emergency setting, while in regional centres similar patients continue to be assessed on the paediatric medical ward / assessment unit and thus receive a paediatric medical specialty code. The exclusion of all emergency presentations from time series and sub-regional analysis may thus differentially exclude a large portion of the workload occurring in large urban centres where access to specialist advice and treatment is available within the Emergency Department setting.

The potential impact of inconsistent uploading of day cases to the NMDS is likely to be greatest for those conditions most commonly treated in the emergency department setting. Analysis of 2001-2003 hospital admission data suggests that >1/3 of NMDS emergency department discharges for those 0-24 years were due to injury, with another 1/3 were due to ambulatory sensitive conditions (e.g. asthma, gastroenteritis, respiratory infections). In contrast, only 2% of those presenting with bacterial meningitis and 4% of those with septic arthritis were discharged with an emergency sub-specialty code.

Further sub-analysis of these two admission categories however demonstrated that inclusion / exclusion of emergency department admissions had quite different effects depending on the category of admission under study (injury vs. ambulatory sensitive admissions) and whether the region had access to a specialist Paediatric Emergency Department. In this analysis the Wider Auckland Region, (comprising 1/3 of the NZ population and whose residents have access to specialist Paediatric Emergency Departments) was compared to the rest of NZ. For ambulatory sensitive admissions, exclusion of emergency department cases resulted in Auckland's admission rates being consistently lower than in the rest of New Zealand. It was only when emergency cases were included in this analysis that Auckland's admission rates began to approximate those of the rest of NZ. In contrast for injuries, inclusion of emergency department cases resulted in hospital admissions in the Auckland Region consistently exceeding the rest of New Zealand. It was only when emergency cases were excluded from the analysis that Auckland's injury admission rates began to approximate those of the rest of

NZ. (These findings occurred despite Auckland having a similar proportion of children living in the most deprived NZDep small areas as the rest of NZ).

Loosely interpreted, the findings of this analysis suggest that the workload of large specialist paediatric emergency departments must not be discounted when examining trends in ambulatory sensitive or other medical admissions, as it is only when emergency cases are included in the analysis that the admission rates of the Wider Auckland Region (with its access to Specialist Paediatric Emergency care) begin to approximate the rest of NZ. In contrast, it is possible that specialist paediatric emergency departments have much less of an influence on admission thresholds for injury, with these being handled in a similar manner by different emergency departments across the country. Thus for injury data, the greater tendency for some emergency departments to upload their cases to the NMDS must be taken into account in any analysis.

Implications for Interpreting Time Series Analyses in these Reports

Throughout this report, analysis of time series and other information has been undertaken using unfiltered hospital admission data, with the exception of the injury and poisoning sections. Here emergency department discharges have been filtered out of the dataset, in an attempt to address some of the inconsistencies discussed above. Despite such an approach, there remains the potential for the inconsistent uploading of day cases to significantly influence the time series analyses presented in this report. In particular, such practices may lead to an over estimate of the number of medical admissions commonly treated in the emergency department setting (e.g. asthma, skin infections, respiratory tract infections), while at the same time the filtering out of injury/poisoning emergency cases may lead to undercounting for a number of more minor types of injury. Nevertheless, the filtering process utilised in this report are thought to provide the best balance when considering hospital admissions amongst those 0-24 years. Despite this, the reader must bear in mind that a potential for significant residual bias remains, when interpreting the time series analyses presented in this report.

2. Data Quality and Coding Changes over Time (ICD-9 and ICD-10)

Change Over from ICD-9 to ICD-10 Coding

From 1988 until June 1999, clinical information in the NMDS was coded using variants of the ICD-9 classification system (ICD-9 CM until June 1995, then ICD-9-CM-A until June 1999). From July 1999 onwards, the ICD-10 classification system has been used, although for time series analysis, back and forward mapping between the two classification systems is possible fusing pre-defined algorithms [291].

The introduction of ICD-10 represents the most significant change in the International Classification of Diseases (ICD) in over 50 years and uses an alphanumeric coding system for diseases in which the first character of the code is always a letter followed by several numbers. This has allowed for the expansion of the number of codes to provide for recently recognised conditions and to provide greater specificity about common diseases (there are about 8,000 categories in ICD-10 as compared to 5,000 in ICD-9). While for most conditions there is a reasonable 1:1 correspondence between ICD-9 and ICD-10 codes, for some this may lead to some irregularities in time series analysis [293]. Where possible such irregularities will be highlighted in the text, although care should still be taken when interpreting time series analysis across the 1999-2000 period as some conditions may not be directly comparable between the two coding systems.

Accuracy of ICD Coding

In recent years the NZHIS has undertaken a number of reviews of the quality of ICD coding in the NMDS. In the latest audit 2,708 events were audited over 10 sites during a 3 month period during 2001/2002. Overall the audit found that 22% of events required a change in coding, although this also included changes at the fourth and fifth character level. The average ICD code change was 16%, with changes to the principal diagnosis being 11%, to additional diagnoses being 23% and to procedure coding being 11%. There were 1,625 external causes

of injury codes, of which 15% were re-coded differently [294]. These findings were similar to an audit undertaken a year previously.

While the potential for such coding errors must be taken into consideration when interpreting the findings of this report, it may be that the 16% error rate is an overestimate, as in the majority of the analyses undertaken in this report, only the principal diagnosis (with an error rate of 11%) is used to describe the reason for admission. In addition, for most admissions the diagnostic category (e.g. lower respiratory tract infections) is assigned using information at the 3 digit level (with the 16% error rate also including issues with coding at the 4^{th} or 5^{th} digit level).

3. Ethnicity Information in the NMDS

The reader is referred to Demography and Measurement of Ethnicity Section for a discussion of this issue.

Conclusion

In general the inconsistencies outlined above tend to make time series and (regional) comparative analyses based on the NMDS less reliable than those based on Mortality or Birth Registration data (where legislation dictates inclusion criteria and the type of information collected). While hospital discharge data still remains a valuable and reasonably reliable proxy for measuring the health outcomes of children and young people in this country, the reader is cautioned to take into consideration the biases discussed above, when interpreting the findings outlined in this report.

Appendix 5: The Birth Registration Dataset

Mode of Data Collection

Since 1995 all NZ hospitals / delivering midwives have been required to notify Internal Affairs (within 5 working day of delivery), of the birth of a live / stillborn baby 20+ weeks gestation or weighting >400g. Prior to 1995, only stillborn babies reaching 28+ weeks of gestation required birth notification. Information on the hospital's notification form includes maternal age, ethnicity, multiple birth status, and baby's sex, birth weight and gestational age. In addition parents must complete a Birth Registration Form within 2 years of delivery, duplicating the above information, with the exception of birth weight and gestational age, which are supplied only on hospital notification forms. Once both forms are received by Internal Affairs, the information is merged into a single entry. This 2-stage process it is thought to capture 99.9% of births occurring in New Zealand and cross checking at the receipting stage allows for the verification of birth detail [295].

Issues to Take into Account When Interpreting Information Derived from the Birth Registration Dataset

Because of the 2-stage birth registration process, the majority of variables contained within the birth registration dataset are >98% complete, and cross checking at the receipting stage (with the exception of birth weight and gestational age) allows for the verification of birth details. In addition, the way in which ethnicity is collected in this dataset confers a number of advantages, with maternal ethnicity being derived from the information supplied by parents on their baby's birth registration form. This has the advantage of avoiding some of the ambiguities associated with hospital and mortality data, which at times have been reported by third parties. Changes in the way ethnicity was defined in 1995 however make information collected prior to this date incomparable with that collected afterwards. For births prior to 1995, maternal ethnicity was defined by ancestry, with those having half or more Māori or Pacific blood meeting ethnic group criteria, resulting in three ethnic groups, Māori, Pacific and non-Māori non-Pacific. For births after 1995 maternal ethnicity was self identified, with an expanded number of ethnic categories being available and parents being asked to tick as many options as required to show which ethnic group(s) they belonged to. For those reporting multiple ethnic affiliations a priority rating system was introduced, as discussed the Demography and Measurement of Ethnicity Section of this report.

Because this dataset captures 99.9% of births occurring in NZ, is >98% complete for most variables, collects self reported ethnicity in a standard manner and is collated and coded by a single agency, information derived from this dataset is likely to be of higher quality than that derived from many of NZ's other data sources. Limitations however include the relatively restricted number of variables contained within the dataset (e.g. it lacks information on maternal smoking, BMI or obstetric interventions) and the lack of cross checking for birth weight and gestational age (which is supplied only on the hospital notification form). The change over in ethnicity definition during 1995 also prohibits time series analysis by ethnicity over the medium to long term. Each of these factors must thus be taken into account when interpreting information in this report that has been derived from the Birth Registration Dataset.

Appendix 6: National Mortality Collection

Mode of Data Collection

The Mortality Collection is a dataset managed by the New Zealand Health Information Service (NZHIS), which classifies the underlying cause, for all deaths registered in NZ since 1988. Fetal and infant data is a subset of the Mortality Collection and contains extra information on factors such as birth weight and gestational age [296].

Each month Births, Deaths and Marriages send NZHIS electronic death registration information, Medical Certificates of Cause of Death and Coroner's reports. Additional information on the cause of death is obtained from the National Minimum Dataset (NMDS), private hospital discharge returns, the NZ Cancer Registry (NZCR), the Department of Courts, the Police, the Land Transport Authority, Water Safety NZ, Media Search and from writing letters to certifying doctors, coroners and medical records officers in public hospitals. Using information from these data sources, an underlying cause of death (ICD-9 and ICD-10) is assigned by NZHIS staff according to the World Health Organisation's rules and guidelines for mortality coding [296].

Data Quality Issues Relating to the Mortality Collection

Unlike the NMDS, where information on the principal diagnosis is coded at the hospital level and then forwarded electronically to the NZHIS, for the Mortality Collection each of the approximately 28,000 deaths occurring in NZ each year is coded manually within NZHIS. For most deaths the Medical Certificate of Cause of Death provides the information required, although coders also have access to the information contained in the NMDS, NZ Cancer Registry, LSTA, Police, Water Safety NZ and ESR [297]. As a consequence, while coding is still reliant on the accuracy of the death certificate and other supporting information, there remains the capacity for a uniform approach to the coding which is not possible for hospital admission data.

While there are few published accounts of the quality of coding information contained in the Mortality Collection, the dataset lacks some of the inconsistencies associated with the NMDS, as the process of death registration is mandated by law and there are few ambiguities as to the inclusion of cases over time. As a consequence, time series analyses derived from this dataset are likely to be more reliable than that provided by the NMDS. One issue that may affect the quality of information derived from this dataset however is the collection of ethnicity data, which is discussed in more detail in the Demography and Measurement of Ethnicity Section of this report.

Appendix 7: ESR Sexual Health Data

Mode of Data Collection

Under the Health Act 1956 and the Tuberculosis Act 1948, health professionals are required to notify their local Medical Officer of Health of any notifiable disease that they suspect or diagnose. Notification data are recorded on a computerised database (EpiSurv) and forwarded weekly to the Institute of Environmental Science and Research (ESR) where the information is collated and analysed on behalf of the Ministry of Health [223].

While Sexually Transmitted Infections (STIs) are not notifiable diseases in New Zealand, data on STIs of public importance (Chlamydia, gonorrhoea, genital herpes, genital warts, syphilis, and non-specific urethritis) are submitted voluntarily to ESR by a number of sexual health clinics, family planning clinics and student and youth health clinics. In addition, laboratory based surveillance data is submitted by laboratories in Auckland, Waikato, and the Bay of Plenty (Chlamydia and gonorrhoea) [223].

Data Quality and Completeness: Sexual Health Data

Currently, surveillance of sexually transmitted infections (STIs) in NZ is voluntary, with information provided by a number of Sexual Health Clinics (SHCs), Family Planning Clinics (FPCs) and Student Youth Health Clinics (SYHCs) nationally, as well as by laboratories in the Auckland, Waikato and Bay of Plenty Regions.

In general, clinic based surveillance systems tend to underestimate the overall burden of STIs in NZ, as a large percentage of these infections are diagnosed by other practitioners in the primary care setting. Laboratories however tend to receive specimens from all providers, making them a useful complimentary source of information in areas where laboratory based surveillance is operating (notification however is limited to Chlamydia and gonorrhoea). In areas where both SHC and laboratory surveillance data is available, estimates suggest that the real rates of Chlamydia are 3x higher and rates of gonorrhoea 2x higher than notifications by SHCs would suggest.

In terms of the information contained in this report, SHC data is probably most useful for highlighting the relative proportions of different types of STI in the primary care setting, as lacking a geographically defined population denominator SHC data is reported as the number of cases per 100 clinic attendees. In contrast, laboratory based surveillance data, which tends to have a more clearly defined geographic denominator, is of greater utility in estimating the overall burden of disease. Because of the patchy coverage however, neither surveillance system is able to provide a reliable estimates of the national burden of disease in this country [283].

Note: While parts of this material are based on data and information provided by the Institute of Environmental Science and Research Ltd on behalf of the Ministry of Health, the analyses, conclusions, opinions and statements expressed herein are those of the authors and not necessarily those of the Institute of Environmental Science and Research Ltd or the Ministry of Health.

Appendix 8: NZ Deprivation Index

The NZ Deprivation Index (NZDep) is a small area index of deprivation, which has been used as a proxy for socioeconomic status in this report. The main concept underpinning small area indexes of deprivation is that the socioeconomic environment in which a person lives can confer risks / benefits which may be independent of their own social position within a community [298]. They are thus aggregate measures, providing information about the wider socioeconomic environment in which a person lives, rather than about their individual socioeconomic status.

The NZDep was first created using information from the 1991 census, but has since been updated following each census. The NZDep2006 combines 9 variables from the 2006 census which reflect 8 dimensions of deprivation (**Table 123**). Each variable represents a standardised proportion of people living in an area who lack a defined material or social resource (e.g. access to a car, income below a particular threshold), with all 9 variables being combined to give a score representing the average degree of deprivation experienced by people in that area. While the NZDep provides deprivation scores at meshblock level (Statistics NZ areas containing approx 90 people), for the purposes of mapping to national datasets, these are aggregated to Census Area Unit level (≈1,000-2,000 people). Individual area scores are then ranked and placed on an ordinal scale from 1 to 10, with decile 1 reflecting the least deprived 10% of small areas and decile 10 reflecting the most deprived 10% of small areas [299].

Table 123. Variables used in the NZDep2006 Index of Deprivation[300]

No.	Factor	Variable in Order of Decreasing Weight in the Index
1	Income	People aged 18-64 receiving means tested benefit
2	Employment	People aged 18-64 unemployed
3	Income	People living in households with income below an income threshold
4	Communication	People with no access to a telephone
5	Transport	People with no access to a car
6	Support	People aged <65 living in a single parent family
7	Qualifications	People aged 18-64 without any qualifications
8	Owned Home	People not living in own home
9	Living Space	People living in households below a bedroom occupancy threshold

The advantage of NZDep is its ability to assign measures of socioeconomic status to the elderly, the unemployed and to children (where income and occupational measures often don't apply), as well as to provide proxy measures of socioeconomic status for large datasets when other demographic information is lacking. Small area indexes have limitations however, as not all individuals in a particular area are accurately represented by their area's aggregate score. While this may be less of a problem for very affluent or very deprived neighbourhoods, in average areas, aggregate measures may be much less predictive of individual socioeconomic status [298]. Despite these limitations however, the NZDep has been shown to be predictive of mortality and morbidity from a number of diseases in New Zealand.

Note: As New Zealand's national datasets have traditionally continued to use the previous Censuses' domicile codes for 1-2 years after any new Census, all of the numerators (e.g. numbers of hospital admissions, deaths) in the previous analyses used NZDep2001 deciles. Because it was necessary to account for population growth between 2001 and 2006 however, denominators were created using both NZDep2001 and NZDep2006 deciles, with linear extrapolation used to create denominators for inter-Census years.

Appendix 9: Ambulatory Sensitive Hospital Admissions

The ASH analysis in this report was performed using two coding algorithms, the new Paediatric ASH Algorithm specifically developed by Anderson et al in conjunction with the New Zealand Child and Youth Epidemiology Service (NZCYES) (**Table 124**), and the old coding algorithm developed by Tobias and Jackson, which was used within the New Zealand health sector until 2008 (**Table 125**).

1. The development of the new Paediatric ASH Coding Algorithm involved four steps:
2. Identification of the most frequent causes of hospital admissions for children and young people in New Zealand using data from the National Minimal Dataset (NMDS).
3. Formation of a convening group to define avoidable morbidity for the purposes of the indicator and to identify key policy areas to be considered in the indicator.
4. Consultation with experts in the paediatric, public health and primary care fields to determine the influence of various policy areas on hospital admissions for the 42 conditions identified in step one. This was an iterative process with the initial feedback being re-circulated to the panel of experts for further consideration before hospitalisations were confirmed as either potentially avoidable or non potentially avoidable. Access to primary care was one of the policy areas considered, with the subset of conditions where the expert panel judged that hospitalisations could potentially be avoided by timely access to appropriate primary care being classified as ASH in the new coding algorithm.
5. Development of a final coding algorithm (Table 124) and consideration of appropriate filters.

The ASH classification finally developed is intended to be representative of hospitalisations that could potentially be prevented by access to primary care in the 0-14 year age group, but is not exhaustive. It is important to note that only conditions consulted on during the process described above were included in the ASH coding algorithm. For example while the majority of cases of epiglottitis can be prevented through vaccination against Hib, and therefore hospitalisations due to epiglottitis might be considered ambulatory sensitive, epiglottitis is rare and was not identified in step one of the process described above. Epiglottitis was therefore not consulted on and was not included in the ASH coding algorithm.

Injury and poisoning are also important causes of childhood morbidity and make up a large proportion of paediatric hospital admissions. However injury and poisoning were not consulted on during this process because of the greater tendency for some emergency departments to upload their cases to the NMDS than others, thus making it difficult to obtain consistent data across DHBs. Ideally injury will be incorporated into the ASH coding algorithm in the future if these data issues can be resolved.

The convening group also determined that a number of filters should be applied to this coding algorithm including:

1. Neonatal Admissions (0-28 days) are specifically excluded (as issues arising in the context of a birth are likely to require different care pathways than those arising in the community-, with the exception of neonatal tetanus and congenital rubella, which can be prevented by timely access of women to immunisation in primary care).
2. Waiting List Admissions are specifically excluded, with the exception of Waiting List admissions for dental caries, as DHBs differ in the way these children are admitted around the country.

Table 124. New Paediatric ASH Codes Developed for the New Zealand Health Sector

Ambulatory Sensitive Conditions	ICD 10 coding
Asthma	J45, J46
Bronchiectasis	J47
Skin Infections	H000, H010, J340, L01-L04, L08, L980
Constipation	K590
Dental Caries	K02, K04, K05
Dermatitis and Eczema	L20-L30
Gastroenteritis	A02- A09, R11
Gastro-Oesophageal Reflux	K21
Nutritional Deficiency	D50- D53, E40-E46, E50- E56, E58-E61, E63, E64
Bacterial/Non Viral Pneumonia	J13-J16, J18
Rheumatic Fever / Heart Disease	I00-I09
Otitis Media	H65-H67
Acute Upper Respiratory Tract Infection	J00-J03, J06
Vaccine Preventable Diseases: Neonatal/Other Tetanus, Congenital Rubella ≥6 months: Pertussis, Diphtheria, Hepatitis B ≥16 months Measles, Mumps, Rubella	A35, A36, A37, A80, B16, B180, B181 A33, A34, P350, B05, B06, B26, M014
ASH Urinary Tract Infection > 4 years	N10, N12, N300, N390, N309, N136
Filters: Codes Apply to Children 0-14 Years (excluding the neonatal period) Acute and Arranged Admissions Only (except Dental Conditions where Waiting List included)	

Note: Coding Algorithm developed by Pip Anderson, Elizabeth Craig, Gary Jackson and Martin Tobias in conjunction with the New Zealand Child and Youth Epidemiology Service

Table 125. Weightings Applied to Potentially Avoidable Hospital Admissions by Jackson and Tobias [162] and Subsequently Used by the New Zealand Ministry of Health [250]

Condition	Population Preventable	Ambulatory Sensitive	Injury Prevention
Tuberculosis	0.5	0.5	0
HIV / AIDS	1	0	0
Skin Cancers	0.5	0.5	0
Oral Cancers	1	0	0
Colorectal Cancer	0.7	0.3	0
Lung Cancer	1	0	0
Breast Cancer	0.3	0.7	0
Nutrition	1	0	0
Alcohol-Related Conditions	1	0	0
Ischemic Heart Disease	1	0	0
Gastroenteritis	0.2	0.8	0
Other Infections	0.2	0.8	0
Immunisation-Preventable	0	1	0
Hepatitis / Liver Cancer	0	1	0
Sexually Transmitted Disease	0	1	0
Cervical Cancer	0	1	0
Thyroid Disease	0	1	0
Diabetes	0.2	0.8	0
Dehydration	0	1	0
Epilepsy	0	1	0
ENT Infections	0	1	0
Rheumatic Fever / Heart Disease	0	1	0
Hypertensive Disease	0.3	0.7	0
Angina	0	1	0
Congestive Heart Failure	0	1	0
Stroke	0.5	0.5	0
Respiratory Infections	0	1	0
CORD	0.6	0.4	0
Asthma	0	1	0
Dental Conditions	0.4	0.6	0
Peptic Ulcer	0	1	0
Ruptured Appendix	0	1	0
Obstructed Hernia	0	1	0
Kidney / Urinary Infection	0	1	0
Cellulitis	0	1	0
Failure to Thrive	0	1	0
Gangrene	0	1	0
Road Traffic Injury	0	0	1
Poisoning	0	0	1
Swimming Pool	0	0	1
Recreation Injury	0	0	1
Sport Injury	0	0	1
Fire	0	0	1
Drowning	0	0	1
Suicide	0	0	1

Appendix 10: The ONS Classification System for Stillbirths

In the Autumn 2002 Health Statistics Quarterly, staff from the UK's Office of National Statistics (ONS) published a new hierarchical classification system for assigning a single cause to stillbirths and neonatal deaths using death certificate data coded in ICD10 [301]. While similar hierarchical classification systems have been developed for use in the Australasian context, such algorithms rely on the coder having access to detailed clinical and other (e.g. post-mortem) information, which is not readily available in de-identified death registration datasets. Thus the ONS Classification System, which relies solely on ICD10 death certificate codes, provides a useful alternative for use in this context.

The ONS Classification System was developed because in the UK, as in New Zealand, the format of Death Certificates makes it impossible to derive a single cause for fetal deaths, as multiple maternal and fetal causes are listed on the same certificate i.e.:

a. Main diseases or conditions in fetus

b. Other diseases or conditions in fetus

c. Main maternal diseases or conditions affecting fetus

d. Other maternal diseases or conditions affecting fetus

e. Other relevant causes

In the ONS Classification System, fetal and maternal conditions mentioned anywhere in lines a-e of the death certificate are taken into account in a hierarchical manner to derive a single underlying cause of death, with causes then being divided into the following categories:

1. Congenital Anomalies
2. Antepartum Infections
3. Asphyxia, Anoxia or Trauma (Antepartum or Intrapartum)
4. Other Specific Conditions
5. Remaining Antepartum Deaths

While not being part of the original ONS Classification, in this report a 6th Category: Unspecified Deaths, has been added to highlight the large number of deaths whose sole fetal cause of death is Unspecified (ICD10 P95 or R99) and for whom no additional maternal causes are listed.

The codes for each of the categories in the ONS Classification are listed in the text box below.

ONS Coding Algorithm

The ONS Coding Algorithm assigns deaths with the ICD10 codes below to a single cause in the following order:

Congenital Anomalies

Main or Other Fetal Conditions: D550–D589, D610, D640, D66–D682, D691–D694, D70–D721, D740, D750, D760–D761, D800–D899, E700–E859, E880–E889, G120–G129, G600–G609, G700–G719, G800– G809, G900–G909, I340–I379, I420–I425, I440–I459, K740–K746, Q000–Q079, Q200– Q239, Q242–Q249, Q251–Q269, Q271–Q289, Q310–Q313, Q318–Q319, Q320–Q349, Q382–Q459, Q600–Q609, Q610–Q611, Q613–Q619, Q620–Q639, Q641–Q649, Q673–Q676, Q743, Q750–Q759, Q761–Q799, Q800–Q819, Q850–Q939, Q960–Q999; *Main or Other Maternal Conditions*: 0350–0352

Antepartum Infections

Main or Other Fetal Conditions: A000–B99, G000–G09, E321, H650–H669, H700–H709, I300–I309, I330–I339, J00–J069, J100–J189, J200–J22, J36, J370–J371, J47, J850–J869, K350–K359, K610–K614, K650–K659, N111, N12, N136, N300, N390, P027, P230–P239, P350–P379, P38, P390–P399; *Main or Other Maternal Conditions*: 0353

Asphyxia, Anoxia or Trauma (Intrapartum and Antepartum)
Main or other Fetal Conditions: P000, P016–P017, P020–P021, P022, P024–P026, P030–P039, P050–P059, P080–P082, P100–P159, P200–P219, P240–P241, P249, P524–P529, P90, P910–P919; *Main or Other Maternal Conditions*: O100–O16, O363, O365, O430–O439, O440–O469, O48, O620–O689, O690–O699

External Conditions
Main or Other Fetal Conditions: E40–E441, E46, P242–P248, J690, P800–P809, P810, P830–P831, P833–P839, P920–P929, V01–Y98

Other Specific Conditions
Main or Other Fetal Conditions: C000–C97, D100–D489, D600–D609, D684, E000–E320, E322–E349, I270, I514, J849, P002, P005–P006, P023, P028–P029, P293, P500–P519, P530–P549, P550–P570, P579, P580–P589, P591–P599, P60–P611, P613–P619, P700–P749, P760–P769, P780–P789, P810– P819, P832, P93, P961–P962; *Main or Other Maternal Conditions*: C000–C97, D100–D369, D370–D489, D600–D609, D684, E000–E320, E322–E349, E349, I130–I139, I470–I499, I514, I710–I719, J450–J459, K529, O240–O249
Other Conditions (Intrapartum and Antepartum)

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